Company: Southern California Gas Company (U 904 G)
Proceeding: 2024 General Rate Case
Application: A.22-05-015/-016 (consolidated)
Exhibit: SCG-208

REBUTTAL TESTIMONY OF

BILL KOSTELNIK

(PIPELINE SAFETY ENHANCEMENT PLAN - PSEP)

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

May 2023

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REBUTTAL TESTIMONY OF BILL KOSTELNIK (PIPELINE SAFETY ENHANCEMENT PLAN - PSEP)

I. SUMMARY OF DIFFERENCES

TOTAL O&M - Constant 2021 ($000)			
	Base Year 2021	**Test Year 2024**	**Change**
SOCALGAS	64,082	54,214	(9,868)
CAL ADVOCATES	64,082	53,359	(10,723)
TURN-SCGC[1]	64,082	50,944	(13,138)

TOTAL CAPITAL - Constant 2021 ($000)					
	2022	**2023**	**2024**	**Total**	**Difference**
SOCALGAS	$141,509	$101,920	$73,810	$317,239	N/A
CAL ADVOCATES	$141,509[2]	$101,920	$73,810	$317,239	0
TURN-SCGC[3]	$137,829	$98,330	$70,251	$306,411	(10,828)

TOTAL O&M & CAPITAL[4] (PSEP REASONABLENESS REVIEW) – Fully Loaded ($000s)				
	Total O&M	Difference	Total Capital	Difference
SOCALGAS	45,013	N/A	453,766	N/A
CAL ADVOCATES	45,013	0	453,766	0
TURN-SCGC	45,013	0	453,766	0

1 TURN-SCGC did not provide a disallowance proposal specific to the Test Year 2024 O&M amount; therefore, as discussed below, this amount has been inferred utilizing the 6.5% reduction proposed by TURN-SCGC for the aggregate value of the hydrotest projects that SoCalGas has identified as candidates for execution within the 2024 GRC period. TURN-SCGC did not recommend a disallowance for miscellaneous O&M costs.

2 Although not specifically included in their proposed reductions, Cal Advocates states on page 10 of their testimony: "On March 13, 2023, SCG provided 2022 recorded adjusted data. The 2022 recorded adjusted capital expenditures were $108.970 million. Due to timing, Cal Advocates did not have time to incorporate into its forecast and R/O Model but recommends that this recorded figure be adopted for 2022."

3 TURN-SCGC did not provide a disallowance proposal for the 2022, 2023, and 2024 amounts comprising SoCalGas's capital forecast; therefore, as discussed below, these amounts have been inferred utilizing the 5.0% reduction proposed by TURN-SCGC for the aggregate value of the capital pipeline projects and capital components of hydrotests that SoCalGas has identified as candidates for execution within the 2024 GRC period. TURN-SCGC did not recommend a disallowance for valve enhancement costs.

4 The associated revenue requirement for the projects presented for reasonableness review is approximately $109 million.

TOTAL CAPITAL (Dairy Pilots) – Fully Loaded ($000s)		
	TOTAL CAPITAL	**Difference**
SOCALGAS	20,262	N/A
CAL ADVOCATES	20,262	0
TURN-SCGC	20,262	0

II. INTRODUCTION

This rebuttal testimony regarding SoCalGas's request for Pipeline Safety Enhancement Plan (PSEP) addresses the following testimony from other parties:

- The Utility Reform Network (TURN) and Southern California Generation Coalition (SCGC), as submitted by Catherine E. Yap (Exhibit TURN-SCGC-03), dated March 27, 2023.
- TURN, as submitted by Garrick Jones (Exhibit TURN-10), dated March 27, 2023.[5]
- The Public Advocates Office of the California Public Utilities Commission (Cal Advocates) as submitted by Dao Phan (Exhibit CA-03), dated March 27, 2023, and the Results of Operations ("RO") Model.

As a preliminary matter, the absence of a response to any particular issue in this rebuttal testimony does not imply or constitute agreement by SoCalGas with the proposal or contention made by these or other parties. The forecasts contained in SoCalGas's direct testimony, performed at the project level, are based on sound estimates of its revenue requirements at the time of testimony preparation.

This rebuttal testimony addresses intervenors' testimony on the following key issues:

- TURN-SCCG's rationale for its proposal for a reduction in the Capital and O&M contingency is flawed and does not reflect the assumptions, lessons learned, and continuous improvement reflected in developing the PSEP forecast.
- SoCalGas's estimating methodology and usage of contingency is consistent with industry standards and has been previously found reasonable by the Commission.

5 The testimony submitted by TURN also opposes SoCalGas's Fleet Services Test Year 2024 O&M request sponsored by Michael Franco (Exhibit (Ex.) SCG-18-R).

- TURN-SCGC's proposed adjustment is in error and is based on a fundamental misunderstanding of SoCalGas's forecast request.
- TURN-SCGC's claim that contingency should be capped to 10% or eliminated altogether is based on faulty logic and does not comport with industry standards.
- TURN's proposal to deny the incremental vehicle request sponsored in Fleet Services Testimony does not take into account the emergent projects and programs that will be undertaken by the Construction organization.
- Cal Advocates' footnote requesting the Commission adopt the 2022 actuals into the Capital Forecast disregards the GRC process and does not consider timing issues and the fact that PSEP projects are not discretionary.
- SoCalGas does not dispute Cal Advocates proposal to normalize SoCalGas Miscellaneous O&M cost request for Capital Delivery Technology given its non-recurring nature.
- Cal Advocates' apparent error in excluding costs from the post-test year of the RO Model is unexplained and unfounded.

For all the reasons stated in the Direct and this Rebuttal testimony, SoCalGas's PSEP forecasts should be adopted by the Commission in their entirety (with the lone exception being Cal Advocate's normalization of O&M costs for capital delivery technology). Authorization of the costs presented in testimony would allow the continued prudent implementation of PSEP, which accomplishes California's pipeline safety enhancement objectives.

A. TURN-SCGC

The following is a summary of TURN-SCGC's position(s) on SoCalGas's PSEP request:[6]

- Opposes SoCalGas's application of contingency to its project-specific estimates, stating: "if the Commission finds it reasonable to provide

[6] Ex. TURN-SCGC-03 (Yap).

contingency factors for these projects, the Commission should authorize no more than a ten percent contingency per project."[7]

- Proposes reductions to the total portfolio value of projects presented in direct testimony, amounting to $20 million for replacements and $28 million for hydrotests.

B. TURN

An introduction to the issues proposed by TURN in Ex. TURN-10 (Jones) is summarized in the rebuttal testimony of SoCalGas Fleet Services witness Michael Franco (Ex. SCG-218).[8]

C. CAL ADVOCATES

The following is a summary of Cal Advocates' position(s) on SoCalGas's PSEP request:[9]

- Proposes a forecast of $53.4 million for TY 2024 Non-Shared O&M, a reduction of $855K thousand from SoCalGas's forecast of $54.2 million.[10]
- Does not oppose SoCalGas's TY 2024 forecast of $50.7 million for hydrotests, and clarifies that the aforementioned O&M reduction is for miscellaneous costs associated with Capital Delivery Technology.[11]
- Does not oppose SoCalGas's Capital forecast of $141.509 million for 2022, $101.920 million for 2023 and $73.810 million for 2024,[12] but states that "On March 13, 2023, SCG provided 2022 recorded adjusted data. The 2022 recorded adjusted capital expenditures were $108.970 million. Due to timing, Cal Advocates did not have time to incorporate into its forecast and R/O Model but recommends that this recorded figure be

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7 *Id*. at 8.

8 TURN does not take issue with any of the costs and associated revenue requirements presented in my direct testimony.

9 Ex. CA-03 (Phan).

10 *Id*. at 2.

11 *Id*. at 8.

12 *Id.* at 2-3.

adopted for 2022."[13] Cal Advocates also includes in its RO Model a reduction of approximately $45 million for post-test year PSEP work.

III. REBUTTAL TO PARTIES' O&M PROPOSALS

A. Non-Shared Services O&M

TOTAL O&M - Constant 2021 ($000)			
	Base Year 2021	**Test Year 2024**	**Change**
SOCALGAS	64,082	54,214	(9,868)
CAL ADVOCATES	64,082	53,359	(10,723)
TURN-SCGC[14]	64,082	50,944	(13,138)

1. CONTINGENCY COSTS

a. TURN-SCGC

i. The O&M Dollar Amount Adjustment Recommended by TURN-SCGC is in Error and Demonstrates a Misunderstanding of SoCalGas's Forecast Request

TURN-SCGC takes issue with SoCalGas's usage of contingency as a fundamental component of the estimates comprising SoCalGas's 2024 GRC request. For hydrotest projects, which include both an O&M and a capital component,[15] TURN-SCGC argues that "the Commission should authorize no more than a ten percent contingency per project."[16] TURN-SCGC indicates that the result of this 10% contingency cap would be to reduce the total "forecast

[13] *Id*. at 10, n.18.

[14] TURN-SCGC did not provide a disallowance proposal specific to the Test Year 2024 O&M amount; therefore, this amount has been inferred utilizing the 6.5% reduction proposed by TURN-SCGC for the aggregate value of the hydrotest projects that SoCalGas has identified as candidates for execution within the GRC period. TURN-SCGC did not recommend a disallowance for miscellaneous O&M costs.

[15] Replacement work is a necessary component of a hydrotest in order to isolate the pipe and install test heads. This replacement activity requires removal of a section of pipe at each end. The non-tested side of the pipeline must be welded with a cap that will be cut out after testing is completed. The pipe that is replaced is typically capitalized, subject to SoCalGas's capitalization policy.

[16] Ex. TURN-SCGC-03 (Yap) at 8.

of PSEP hydrotesting cost"[17] from $441.457 million to $412.973 million, or approximately $28 million.[18]

As an initial matter, the dollar amount of TURN-SCGC's recommended O&M adjustment is based on a misunderstanding of SoCalGas's Test Year 2024 O&M request as presented in direct testimony. As clearly explained in testimony, "rather than presenting a forecast that relies on the execution of specific projects in specific years (as was the case in A.17-10-008), SoCalGas is instead requesting authorization to establish a revenue requirement based on an anticipated level of executable spending from a portfolio of 33 Phase 1B and 2A pipeline projects.[19] As such, the capital and O&M forecasts requested in this GRC application will be less than the total costs of the overall portfolio of projects included as supplemental workpapers."[20] This approach is reasonable as it "allows SoCalGas to quickly respond to project execution schedule changes by advancing projects from the overall 33-project portfolio into construction in place of those that are delayed. This maximizes SoCalGas's ability to execute PSEP 'as soon as practicable' in accordance with the Commission mandate laid out in D.11-06-017, and in alignment with GRC-authorized spending levels."[21]

Utilizing this forecast methodology, SoCalGas is requesting a revenue requirement to complete PSEP hydrotest projects that is based on a test year 2024 O&M amount of $50.682 million,[22] not the $441.457 million amount that is presented in Table 3 of TURN-SCGC's testimony.[23] Since TURN-SCGC did not provide a disallowance recommendation based on SoCalGas's test year 2024 forecast, SoCalGas must infer this amount from TURN-SCGC's testimony and workpapers. The adjusted proposed disallowance amount is ascertained by applying a reduction percentage of 6.45%; this figure is derived by dividing the recommended

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17 *Id*.

18 Per TURN-SCGC's workpapers, this amounts to approximately $19M in O&M costs and $9M in capital costs.

19 The capital portfolio also includes a small number of remaining valve enhancement plan projects.

20 Ex. SCG-08 (Kostelnik) at BGK-19.

21 *Id*. at 20.

22 As shown in Exhibit SCG-08, SoCalGas's overall TY 2024 O&M amount, which includes miscellaneous costs as described in Exhibit SCG-08, is $54.214M. TURN-SCGC did not take issue with SoCalGas's miscellaneous costs request.

23 Ex. TURN-SCGC-03 (Yap) at 7.

adjustment, $28.484 million, by the total hydrotest project portfolio value of $441.457 million. Reducing SoCalGas's test year 2024 forecasted O&M amount for hydrotests by 6.45% results in a revised amount of $47.412 million relative to SoCalGas's proposed $50.682 million[24] figure (or $3.27 million).

This calculation is being provided to demonstrate what the hypothetical reduction recommended by TURN-SCGC would be and is by no means an endorsement by SoCalGas that such a reduction is reasonable. Rather, as demonstrated below, TURN-SCGC's arguments regarding contingency are incorrect and should be dismissed.

ii. SoCalGas's Estimating Methodology and Usage of Contingency is Consistent with Industry Standards and Has Been Previously Found Reasonable by the Commission

TURN-SCGC correctly recognizes SoCalGas's adherence to the AACE international standard in its production of project-specific cost estimates to support the requested SoCalGas 2024 GRC revenue requirement for PSEP. Certain testimony is dedicated to describing this process, which includes "very detailed cost projections"[25] to support the individual risk assessments for various cost categories. As acknowledged by TURN-SCGC,[26] the Commission previously found SoCalGas's use of contingency reasonable, stating: "We agree with the addition of a risk assessment component in this instance to account for contingencies that may occur. The proposed projects are subject to many variables and projects have particular circumstances that add to the difficulty of making accurate cost estimates. The practice is also an industry-recommended practice that aims to increase the quality and accuracy of estimates, which we find appropriate for the proposed PSEP projects."[27]

While the Commission did impose a 10 percent reduction to SoCalGas's contingency amounts for the projects included in A.17-10-008, the Commission's language in D.19-09-051 clearly conveys agreement with SoCalGas's estimating approach, which follows industry

[24] SoCalGas's TY 2024 O&M forecast also includes $3.532M in miscellaneous costs which were unopposed by TURN-SCGC.

[25] Ex. TURN-SCGC-03 (Yap) at 2.

[26] *Id.* at 3.

[27] D.19-09-051 at 205.

standards and provides for contingency as a means to address "unforeseeable events that … lead to additional costs,"[28] and recognizes that "project managers have a tendency to underestimate the cost of a project."[29]

It is clear from the Commission's conclusions laid out in D.19-09-051 that TURN-SCGC's suggestion that "the Commission has generally viewed contingency factors with considerable skepticism"[30] is inconsistent with how the Commission has ruled on the specific issue of contingency as it pertains to SoCalGas's PSEP.[31] Despite this recent history on the matter, TURN-SCGC again reference the same examples cited in their 2019 GRC direct testimony on this issue. These examples come from final decisions ranging from 2003 to 2014 and are repeated without explaining why the Commission's prior decisions on contingency should apply in this case.

iii. SoCalGas's Request in the Current Proceeding Reflects Lessons Learned and an Estimating Process That Continually Improves

Despite this approval of SoCalGas's estimating methodology in D.19-09-051, TURN-SCGC states that "SoCalGas again proposes to include a contingency factor in excess of 15 percent for numerous PSEP Phase 1B and 2A projects."[32] TURN-SCGC labels any project contingency amounts over 15 percent as "excessive."[33] As TURN-SCGC notes,[34] detailed cost projections are developed *for each project*. Therefore, some projects might exceed the 15 percent amount that the Commission authorized in D.19-09-051, but others are lower. As

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[28] *Id.* at 204

[29] *Id*.

[30] Ex. TURN-SCGC-03 (Yap) at 3.

[31] In D.19-03-025 the CPUC authorized in full SoCalGas's $255M request associated with 12 Phase 1B and Phase 2A hydrotest and replacement projects that were estimated utilizing the same methodology at issue here. The Commission concluded "Applicants demonstrated that their forecasted costs associated with the twelve PSEP projects are supported by a robust analysis of each project; are based on specific project design and engineering data developed; and are worthy of consideration as a reasonable basis for ratemaking and revenue requirement requested in the Application").

[32] TURN-SCGC-03 (Yap) at 3.

[33] *Id.* at 5, 7.

[34] *Id.* at 2:14-20.

TURN-SCGC acknowledges in Tables 1[35] and 3[36], 12 out of the 30 projects presented are at *or below* 15 percent. SoCalGas's contingency methodology includes a risk assessment with specific amounts allocated to the various project cost categories, and reflects the unique characteristics of individual projects. Furthermore, the contingency amounts for the overall project portfolios presented in this application reveal that the contingency amounts for hydrotest projects *average* 16 percent; whereas capital pipeline projects *average* 15 percent. The average contingency amount for all hydrotest and capital pipeline projects is 16 percent. This figure is within one percent of the amount previously found reasonable by the Commission in D.19-09-051 and falls within the lower end of the range of expected contingency percentages (15-30%) published by AACE International.[37]

Additionally, the range of contingency percentages for projects where Class 3 estimates were developed was 12 to 20 percent.[38] Since the time that A.17-10-008 was submitted, SoCalGas's estimating process has improved. By incorporating lessons learned from estimating and executing the Phase 1B and Phase 2A projects included in A.17-10-008, SoCalGas has refined its contingency amounts for the projects presented in A.22-05-015, which is evidenced by the data points discussed above.[39] A narrower range of contingency percentages for the projects presented in this proceeding reflects a higher confidence level in the assumptions underlying the base estimates and the potential uncertainties analyzed through the risk assessments conducted. SoCalGas's efforts to reduce contingency amounts over time reflects the exhaustive efforts of SoCalGas estimators and project teams to better understand the risks that

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35 *Id.* at 5.

36 *Id.* at 7.

37 Rothwell, G. 2005. *Cost Contingency as the Standard Deviation of the Cost Estimate.* Cost Engineering, Vol. 47, No. 7, at 22-25. *Available at:* https://www.researchgate.net/publication/237635336_Cost_Contingency_as_the_Standard_Deviation_of_the_Cost_Estimate_for_Cost_Engineering.

38 A small number of less costly projects were estimated at a Class 4 level due to the limited scope information available at the time of filing. As typical of Class 4 estimates, the contingency percentages are higher for these projects relative to those with Class 3 estimates.

39 SoCalGas's contingency amounts presented in A.17-10-008 ranged from 18 percent to 33 percent with Pressure Test Projects averaging 26 percent and Replacement Projects averaging 25 percent.

can be expected on a given project and to incorporate knowledge gained over time into the estimating process.[40]

iv. Lessons Learned Have Been Applied to the Development of the Base Estimate as well as Contingency

The forecasted costs of a project are dependent on more than just contingency. This is acknowledged by TURN-SCGC as stated in their testimony: "Consistent with AACE standards, SoCalGas includes a contingency factor as part of its cost estimate."[41] With the development of its 2024 GRC forecast, SoCalGas has also endeavored to refine the known factors that comprise the base estimate. At the time of estimate creation, the engineering design is only approximately 10% to 40% complete and the project may still be multiple years out from construction. As an example, after the 2019 GRC was filed, it was determined during detailed design that many of the hydrotest projects could be executed with fewer test sections by increasing the test pressure relative to the amounts assumed in creating the base estimate without sacrificing safety or reliability. This design change significantly reduces the scope as well as the overall costs of a project. Design changes such as these demonstrate the realization of a sensible PSEP cost-savings opportunity through scope refinement, which is consistent with the four over-arching objectives of PSEP.[42]

A prominent example of this is offered by the Line 2000 Blythe to Cactus City hydrotest project, which was authorized in D.19-09-051[43] and completed in 2021. During the development of the Class 3 estimate to support this project, the estimating team used a test criterion of a maximum test pressure of 95% of the Specified Minimum Yield Strength (SMYS) at the test section low-point based on previous projects of comparable scope and size that were being planned concurrently. Following an engineering evaluation of the feasibility of increasing the

[40] Ex. SCG-08 (Kostelnik) at BGK-20 (These continuous improvements, which are managed and implemented by a dedicated estimating department, are evidenced by the incorporation of "actual costs…as they are incurred in the field" into the estimating tool, and the engagement of subject matter experts that "use their expertise and professional experience to provide estimate assumptions for their areas that form the basis of each estimate.").

[41] TURN-SCGC-03 (Yap) at 2.

[42] *Id*. at 8.

[43] *See* D.19-09-051 at 205-206, 766 (Conclusion of Law 38).

test pressure, as discussed above, the project team determined that the testing criteria could safely be adjusted to 100% SMYS. This change reduced the project's test sections from 32 to 10. As a result, the project team achieved a reduction of approximately 16.5 acres of disturbance[44] due to less work areas from test breaks over the 64-mile-long project. This resulted in cost savings stemming from notable decreases in (1) planning and procurement of land, (2) material and excavation needed to construct the project, (3) mobilization required during construction, and (4) environmental mitigation. Furthermore, the reduced schedule associated with a more focused scope of work resulted in a smaller outage window, with an associated benefit to customers and the overall reliability of the system as the pipeline could be brought back into service sooner following the completion of the work.

Projects such as the one described above provide an opportunity for SoCalGas to incorporate lessons learned into the project estimating, development and execution strategies, which are reflected in the 2024 GRC forecast. To this end, SoCalGas is ever mindful of revisiting its estimating process, as we have described above, with an eye toward producing the highest quality estimates possible. However, as SoCalGas has done with the aforementioned project, an opportunity to execute a project in a manner that reduces costs and execution complexities and benefits ratepayers, should be pursued, even if it causes a deviation from the original estimate developed.

v. TURN-SCGC's Claim that Contingency Should Be Capped at 10 Percent (or Eliminated Altogether) is Based on Faulty Logic and Does Not Comport with Industry Standards

Citing the list of PSEP projects presented for review as shown in Table 2,[45] TURN-SCGC appears to suggest, albeit vaguely, that the 10% variance associated with the defined project list should somehow dictate a blanket, indiscriminate cap on SoCalGas's application of contingency. TURN-SCGC apparently bases their logic on the fact that since "SoCalGas has been successful on average in meeting or even beating its PSEP budgets"[46] the Commission

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[44] No work areas were needed on lands owned by various governmental entities such as the Bureau of Indian Affairs, Metropolitan Water District, and State of California, and significantly less work area was needed lands owned by the Bureau of Land Management.

[45] Ex. TURN-SCGC-03 (Yap) at 6.

[46] *Id.* at 6.

should in turn "authorize no more than a ten percent contingency per project."[47] TURN-SCGC has provided no other explanation or rationale as to why the contingency should be capped at 10 percent. As already indicated above and in direct testimony, the overall costs of a project are comprised of both a base estimate and contingency, both of which SoCalGas specifically estimates for each PSEP project. Applying such a cap would be arbitrary, and would disregard the work SoCalGas undertakes to provide specific estimates for each project. The contingency amount, which addresses the potential for certain risks to materialize, is a far smaller percentage of the overall cost of a project. Therefore, it is erroneous to conclude that a 10 percent contingency should apply due to a 10 percent aggregate cost underrun for a limited, defined list of projects. Additionally, as SoCalGas has already stated in section 2.a.iii. above, *the low end* of the accepted range of contingency percentages for a Class 3 estimate, as established by AACE International, is 15 percent.[48] TURN ignores this fact by suggesting a 10 percent cap, which would be well outside of the accepted range.

It bears repeating that, consistent with AACE recommended practices, a risk assessment component for a project estimate is necessary for all classes of estimates to accurately account for unforeseen events that will likely result in additional costs to the project within the defined scope. In stating that "The Commission could reasonably reject any contingency factors for these projects, given SoCalGas's even greater experience with implementing PSEP [replacement] projects than in the TY2019 GRC,"[49] TURN-SCGC errs in their apparent assumption that the passage of time and experience gained should alleviate the need for a contingency. This is simply wrong and contrary to industry standards and the Commission's previous determination of reasonableness in D.19-09-051. As recognized in AACE International Recommended Practice No. 97R-18 (included in Appendix A), contingency is appropriately

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47 *Id.* at 8.

48 Rothwell, G. 2005. *Cost Contingency as the Standard Deviation of the Cost Estimate.* Cost Engineering, Vol. 47, No. 7, at 22-25. *Available at:* https://www.researchgate.net/publication/237635336_Cost_Contingency_as_the_Standard_Deviation_of_the_Cost_Estimate_for_Cost_Engineering.

49 *Id*.

included in estimates "to quantify the uncertainty and risk associated with the specific project."[50] This is why the definition of an estimate necessarily includes the contingency element, as established by AACE.

Furthermore, imposing a cap on contingency at the portfolio level effectively negates the extensive work project managers, estimators, and subject matter experts completed to determine each individual project's risk profile based on their specific scope definition, attributes, and project level risks that were deliberated in detail during risk assessments.[51] Reducing this significant effort to a blanket percentage based on the limited dataset TURN-SCGC provided is contrary to the application of AACE standards which the Commission has already deemed reasonable in prior cases. AACE repeatedly indicates in its RP 97R-18 "Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Pipeline Transportation Infrastructure Industries"[52] that their estimate accuracy and ranges only apply to projects that include contingency based on risk assessments. Contingency is needed to allocate funding for unforeseen events, and is a recognized part of an estimate, similar to materials, construction costs, and other cost elements.

2. FLEET SERVICES

a. TURN

TURN argues that SoCalGas has failed "to provide sufficient justification for their forecasts of incremental vehicles to support incremental activities and staff."[53] The following provides such justification for the incremental vehicle request.

As stated in direct testimony, "In 2019, the PSEP organization, along with other departments that execute major projects, were aligned into an overarching Construction organization. SoCalGas's vision for this organization was to create a scalable, consistent framework for infrastructure project management and execution."[54] Furthermore, the purpose of

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[50] AACE International, Recommended Practice No. 97R-18 "Cost Estimate Classification System - As Applied in Engineering, Procurement, and Construction for the Pipeline Transportation Infrastructure Industries" (Bredehoeft et al.) at 5, attached as Appendix B.

[51] *See* Ex. SCG-08 (Kostelnik) at BGK-20.

[52] *See* Appendix B at 5.

[53] Ex. TURN-10 (Jones) at 10.

[54] Ex. SCG-08 (Kostelnik) at BGK-45.

this organization is to "promote consistency in the application of project management and execution practices across the portfolio of major projects."[55] To this end, the Construction organization is now responsible for the execution of the capital portfolio of major projects, including those not specifically within the scope of PSEP.[56]

The incremental vehicle request associated with the overall Construction organization portfolio is necessary to support these varied project efforts. This is consistent with PSEP's sponsorship of other Construction organization-related O&M costs as described in testimony (*e.g.* Construction Labor Costs and Capital Delivery Technology[57]). Furthermore, many of the same estimators, project managers, construction managers, safety personnel, and other staff that support and oversee the implementation of PSEP will also perform the same job duties in support of other major capital projects such as GTSR Part 1. The projects that will be necessary to comply with PHMSA's requirements codified as GTSR Part 1 will compare to PSEP in size and scope and as such, will require incremental vehicles to support these newly scoped projects. As shown on Table KS-27[58] in the Gas Integrity Management Programs testimony of Travis Sera and Amy Kitson, the capital forecast increases significantly as the program begins to mature from 2022 to 2024.

The vehicle request discussed above is for 48 incremental vehicles. The usage of these incremental vehicles will enable the successful implementation of major capital projects executed by the Construction organization in the 2024 GRC period, primarily associated with the emergent GTSR Part 1 program. Given the large increase in capital spending associated with the

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55 Id.

56 In addition to PSEP, the Construction organization plans and executes projects sponsored by Gas Transmission and Storage base capital, Gas Transmission Collectible, Compressor station modernization projects, natural gas vehicle fueling stations, and Senate Bill 1383 Dairy Pilots. Another large contributor of new, large capital projects to the Construction organization's capital portfolio is the Pipeline Hazardous Materials Safety Administration's recent promulgation of the first part of the Pipeline Safety: Safety of Gas Transmission and Gathering Pipelines rulemaking (also referred to by SoCalGas as the Gas Transmission Safety Rule (GTSR) Part 1), which expands requirements for gas transmission operators including those related to the Transmission Integrity Management Program (TIMP) [See additional discussion in the direct testimony of Travis Sera and Amy Kitson (Gas Integrity Management Programs, Ex. SCG-09)].

57 Ex. SCG-08 (Kostelnik) at BGK-45-46.

58 Ex. SCG-09 (Kitson/Sera) at AK-TS-94.

implementation of this program, the Commission should adopt SoCalGas's proposal and dismiss TURN's contention that the forecast should be disallowed.

3. NORMALIZATION OF O&M COSTS

a. CAL ADVOCATES

Cal Advocates disagrees with the Test Year O&M forecast for SoCalGas's Miscellaneous Costs. Cal Advocates' recommendation is based on SoCalGas's statement that one of its Miscellaneous Costs components, Capital Delivery Technology, is non-recurring. Cal Advocates cites SoCalGas's response to SoCalGas-2024 GRC MDR-SECTION B, Question 11, which states "These costs are expected to be spent mainly in 2024 with minimal trailing costs in the Post-Test Years." Cal Advocates does not oppose the request per se. However, Cal Advocates recommends that "the Commission normalize SCG's request over the 4-year GRC cycle to reflect the O&M costs more accurately in rates. The normalization of SCG's request results in an O&M amount of $285,000 for 2024 and for each year of the years in this GRC cycle. The normalization of the Capital Technology Costs leads to a reduction in SCG's Miscellaneous Cost from $3.532 million to $2.677 million which is an overall decrease of $855,000 from SCG's 2024 request."[59]

SoCalGas does not oppose Cal Advocates' recommendation to normalize the forecast associated with Capital Technology costs over the four-year rate case period.

IV. REBUTTAL TO PARTIES' CAPITAL PROPOSALS

TOTAL CAPITAL - Constant 2021 ($000)					
	2022	**2023**	**2024**	**Total**	**Difference**
SOCALGAS	$141,509	$101,920	$73,810	$317,239	N/A
CAL ADVOCATES	$141,509[60]	$101,920	$73,810	$317,239	0
TURN-SCGC[61]	$137,829	$98,330	$70,251	$306,411	(10,828)

[59] Ex. CA-03 (Phan) at 9.

[60] According to Cal Advocates on page 10 of their testimony: "On March 13, 2023, SoCalGas provided 2022 recorded adjusted data. The 2022 recorded adjusted capital expenditures were $108.970 million. Due to timing, Cal Advocates did not have time to incorporate into its forecast and R/O Model but recommends that this recorded figure be adopted for 2022." Ex. CA-03 (Phan) at 10, n.18.

[61] As stated above (n.3), TURN-SCGC did not provide a disallowance proposal for the 2022, 2023, and 2024 amounts comprising SoCalGas's capital forecast; therefore, these amounts have been inferred utilizing the 5.0% reduction proposed by TURN-SCGC for the aggregate value of the capital pipeline

A. Disputed Capital Costs

1. CAL ADVOCATES

Cal Advocates does not dispute SoCalGas's capital request. However, Cal Advocates notes in a footnote that "On March 13, 2023, [SoCalGas] provided 2022 recorded adjusted data. The 2022 recorded adjusted capital expenditures were $108.970 million. Due to timing, Cal Advocates did not have time to incorporate into its forecast and R/O Model but recommends that this recorded figure be adopted for 2022."[62]

SoCalGas disagrees with Cal Advocates' apparent attempt to select what they believe to be a useful data point and make a vague recommendation based on this data point in isolation. Cal Advocates does so with no consideration of the downstream impact to the capital requests being made in 2023 and 2024. For a program as large and complex as PSEP, which has been described in direct testimony can be subject to various delays,[63] it is demonstrable that the reduced 2022 capital expenditures relative to the forecasted amount provided less than one year earlier, is the result of project deferrals. Historically, certain PSEP projects have been deferred while others have been accelerated, and the same is true for 2022. Further, PSEP work is not discretionary, it is mandated compliance work codified in Public Utilities Code Sections 957 and 958. Therefore, it is not a question as to if PSEP projects will be executed as PSEP consists of a finite set of projects to be executed "as soon as practicable."[64] SoCalGas could have experienced higher than forecasted capital expenditures in 2022 but would not be afforded an opportunity to re-visit its 2024 GRC forecasts and associated revenue requirement. Cal Advocates ignores this reality and simply chooses to recommend a lower amount for 2022 and 2022 alone, introducing no evidence on which to base their recommendation.

In addition, in Cal Advocates' RO Model, Cal Advocates has removed approximately $45 million in costs for the post-test years for PSEP Capital. This removal is unexplained and is inconsistent with Cal Advocates' statement that it does not oppose SoCalGas's capital request for PSEP, and the exclusion appears to potentially be an error. As referenced in the response to

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projects that SoCalGas has identified as candidates for execution within the GRC period. TURN-SCGC did not recommend a disallowance for valve enhancement costs.

[62] Ex. CA-03 (Phan) at 10, n.18.

[63] *See* Ex. SCG-08 (Kostelnik) at BGK-19-20.

[64] D.11-06-017 at 19.

PAO-SCG-107-JOH-Q1 (attached as Appendix C), it is necessary for these PSEP projects to be included for the purpose of receiving the appropriate overhead loading.[65] These are necessary and reasonable costs for these projects and should be approved.

2. TURN-SCGC

a. The Capital Dollar Amount Adjustment Recommended by TURN-SCGC is in Error and Constitutes a Fundamental Misunderstanding of SoCalGas's Forecast Request

As discussed above, TURN-SCGC takes issue with SoCalGas's usage of contingency to address unforeseeable events that may occur during the execution of a project. As with hydrotest projects, TURN-SCGC argues that the replacement projects included in SoCalGas's testimony should be subject to "no more than a ten percent contingency per project…."[66] TURN-SCGC indicates that the result of this 10% contingency cap would be to reduce the "forecast for PSEP replacement costs"[67,68] from $412.196 million to $391.792 million, or approximately $20 million.

As discussed above, TURN-SCGC's recommended capital adjustment is based on a misunderstanding of SoCalGas's 2022-2024 capital request as presented in direct testimony. As clearly explained in direct testimony, "rather than presenting a forecast that relies on the execution of specific projects in specific years (as was the case in A.17-10-008), SoCalGas is instead requesting authorization to establish a revenue requirement based on an anticipated level of executable spending from a portfolio of 33 Phase 1B and 2A pipeline projects. As such, the capital and O&M forecasts requested in this GRC application will be less than the total costs of the overall portfolio of projects included as supplemental workpapers."[69] This approach is reasonable as it "allows SoCalGas to quickly respond to project execution schedule changes by advancing projects from the overall 33-project portfolio into construction in place of those that are delayed. This maximizes SoCalGas's ability to execute PSEP "as soon as practicable" in

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65 The RO Model included another reduction that SoCalGas agreed with that was identified and explained in PAO-SCG-107-JOH-Q1.

66 Ex. TURN-SCGC-03 (Yap) at 7.

67 *Id*.

68 TURN-SCGC's calculation addresses the total cost of the hydrotest projects and does not distinguish between O&M and capital components.

69 Ex. SCG-08 (Kostelnik) at BGK-19.

accordance with the Commission mandate laid out in D.11-06-017, and in alignment with GRC-authorized spending levels."[70]

Utilizing this forecast methodology, SoCalGas is requesting a revenue requirement to complete PSEP capital pipeline projects that is based on a 2022-2024 capital forecast of $202.651 million,[71,72] not the $412.196 million amount that is presented in Table 1 of TURN-SCGC's testimony.[73] Since TURN-SCGC did not provide a disallowance recommendation based on SoCalGas's 2022-2024 capital forecast, SoCalGas must infer this amount from TURN-SCGC's testimony and workpapers. The theoretical disallowance amount can be ascertained by applying a percentage of 4.95%; this figure is derived by dividing the recommended adjustment, $20.405 million, by the total capital pipeline project portfolio value of $412.196 million. Reducing SoCalGas's 2022-2024 capital forecast amount for capital pipeline projects (including the capital components of hydrotests) by 4.95% results in a revised amount of $191.823 million relative to SoCalGas's proposed $202.651 million figure. Therefore, SoCalGas's overall 2022-2024 capital request would be reduced by ~$10 million, not the $20 million figure TURN-SCGC cited in their testimony.

The Commission should understand that this calculation is being provided to demonstrate to the Commission what the hypothetical reduction recommended by TURN-SCGC would be, and is by no means an endorsement or admission by SoCalGas that such a reduction is reasonable. As previously discussed in section III.A.1. above, TURN-SCGC's arguments regarding contingency are incorrect and should be dismissed.

V. CONCLUSION

To summarize, the detailed cost estimates developed in support of the PSEP forecast necessarily include a risk assessment component that is appropriate and, as acknowledged by TURN-SCGC, is consistent with industry-accepted standards established by AACE

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70 *Id*. at 20.

71 This figure includes costs associated with capital pipeline projects, which reflect replacement, derate, and abandonment projects, and also includes the capital components of hydrotest projects.

72 As shown in Ex. SCG-08, SoCalGas's 2022-2024 capital request, which includes the valve enhancement plan as described in Exhibit SCG-08, is $317.239M. TURN-SCGC did not challenge the capital request associated with SoCalGas's valve enhancement plan.

73 Ex. TURN-SCGC-03 (Yap) at 5.

International, an industry association of professionals in the field. Further, the Commission should reject the arbitrary use of 2022 Capital actual costs and approve the incremental vehicle request sponsored in the Fleet Services testimony for the reasons stated herein. Finally, the Commission should approve the forecasts described in the Direct Testimony, with the one acknowledged concession to Cal Advocates' O&M forecast recommendation, so that SoCalGas can continue this important safety work to meet the Commission's objective to execute PSEP as soon as practicable while meeting SoCalGas's PSEP objectives to (1) enhance public safety; (2) comply with Commission directives; (3) minimize customer impacts; and (4) maximize the cost effectiveness of safety investments.

This concludes my prepared rebuttal testimony.

APPENDIX A

GLOSSARY OF TERMS

APPENDIX A

GLOSSARY OF TERMS

<u>**ACRONYM**</u>	<u>**DEFINITION**</u>
AACE	Association for the Advancement of Cost Engineering
A.	Application
CA	Cal Advocates
Commission	California Public Utilities Commission
D.	Decision
GRC	General Rate Case
GTSR	Gas Transmission Safety Rule
MAOP	Maximum Allowable Operating Pressure
O&M	Operations & Maintenance
PAO	Public Advocates Office
PSEP	Pipeline Safety Enhancement Plan
R/O Model	Results of Operations Model
SCGC	Southern California Generation Coalition
SDG&E	San Diego Gas & Electric Company
SMYS	Specified Minimum Yield Strength
SoCalGas	Southern California Gas Company
TURN	The Utility Reform Network
TURN-SCGC	The Utility Reform Network and Southern California Generation Coalition
TY	Test Year

APPENDIX B

AACE International Recommended Practice No. 97R-18: Cost Estimate Classification System – As Applied in Engineering, Procurement and Construction for the Pipeline Transportation Infrastructure Industries

AACE INTERNATIONAL RECOMMENDED PRACTICE

97R-18

COST ESTIMATE CLASSIFICATION SYSTEM – AS APPLIED IN ENGINEERING, PROCUREMENT, AND CONSTRUCTION FOR THE PIPELINE TRANSPORTATION INFRASTRUCTURE INDUSTRIES

AACE INTERNATIONAL

AACE® International Recommended Practice No. 97R-18

COST ESTIMATE CLASSIFICATION SYSTEM – AS APPLIED IN ENGINEERING, PROCUREMENT, AND CONSTRUCTION FOR THE PIPELINE TRANSPORTATION INFRASTRUCTURE INDUSTRIES

TCM Framework: 7.3 – Cost Estimating and Budgeting

Rev. August 7, 2020

Note: As AACE International Recommended Practices evolve over time, please refer to web.aacei.org for the latest revisions.

Any terms found in AACE Recommended Practice 10S-90, *Cost Engineering Terminology*, supersede terms defined in other AACE work products, including but not limited to, other recommended practices, the *Total Cost Management Framework*, and *Skills & Knowledge of Cost Engineering*.

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Disclaimer: The content provided by the contributors to this recommended practice is their own and does not necessarily reflect that of their employers, unless otherwise stated.

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COST ESTIMATE CLASSIFICATION SYSTEM – AS APPLIED IN ENGINEERING, PROCUREMENT, AND CONSTRUCTION FOR THE PIPELINE TRANSPORTATION INFRASTRUCTURE INDUSTRIES

TCM Framework: 7.3 – Cost Estimating and Budgeting

August 7, 2020

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1. PURPOSE

As a recommended practice (RP) of AACE International, the *Cost Estimate Classification System* provides guidelines for applying the general principles of estimate classification to project cost estimates (i.e., cost estimates that are used to evaluate, approve, and/or fund projects). The *Cost Estimate Classification System* maps the phases and stages of project cost estimating together with a generic project scope definition maturity and quality matrix, which can be applied across a wide variety of industries and scope content.

This recommended practice provides guidelines for applying the principles of estimate classification specifically to project estimates for engineering, procurement, and construction (EPC) work for the pipeline transportation infrastructure industries. It supplements the generic cost estimate classification RP 17R-97 [1] by providing:

- A section that further defines classification concepts as they apply to the pipeline transportation infrastructure industries.
- A chart that maps the extent and maturity of estimate input information (project definition deliverables) against the class of estimate.

As with the generic RP, the intent of this document is to improve communications among all the stakeholders involved with preparing, evaluating, and using project cost estimates specifically for the pipeline transportation infrastructure industries.

The overall purpose of this recommended practice is to provide the pipeline transportation infrastructure industries with a project definition deliverable maturity matrix that is not provided in 17R-97. It also provides an approximate representation of the relationship of specific design input data and design deliverable maturity to the estimate accuracy and methodology used to produce the cost estimate. The estimate accuracy range is driven by many other variables and risks, so the maturity and quality of the scope definition available at the time of the estimate is not the sole determinate of accuracy; risk analysis is required for that purpose.

This document is intended to provide a guideline, not a standard. It is understood that each enterprise may have its own project and estimating processes, terminology, and may classify estimates in other ways. This guideline provides a generic and generally acceptable classification system for the pipeline transportation infrastructure industries that can be used as a basis to compare against. This recommended practice should allow each user to better assess, define, and communicate their own processes and standards in the light of generally-accepted cost engineering practice.

2. INTRODUCTION

For the purposes of this document, the term *pipeline transportation* is assumed to include onshore and offshore pipelines for transportation of gas and liquids in the infrastructure industries. The gas and liquids can be of any type including but not limited to hydrocarbons, chemicals and water. This primarily covers pipelines under pressure (e.g., steel, composite, etc.) and not gravity drainage (e.g., concrete). This excludes piping within a process plant, mining facility, utilities plant or other facility site. It also excludes pumping and compression stations and storage and shipping terminals. The defining deliverables of those excluded process (e.g., plant piping) and civil (e.g., drainage) project scopes are covered in other RPs (e.g., 18R-97 for process plants [2] and 56R-08 [3] for general construction).

Pipeline transportation is considered an element of the infrastructure industry. The Construction Industry Institute has provided a good definition of infrastructure in its Project Definition Rating Index for Infrastructure Projects as follows [4]:

"A capital project that provides transportation, transmission, distribution, collection or other capabilities supporting commerce or interaction of goods, services, or people. Infrastructure projects generally impact multiple jurisdictions, stakeholder groups and/or a wide area. They are characterized as projects with a primary purpose that is integral to the effective operation of a system. These collective capabilities provide a service that is made up of nodes and vectors into a grid or system."

Using this definition, pipeline transportation is a vector or linear scope element that connects pumping or compression facilities or storage or shipping terminal nodes at its terminations or intermediate points. The pumping and compression facility nodes are integral elements of pipeline project scope; however, because their design and execution differ greatly from the pipeline itself, they are excluded here. Likewise, terminals (e.g., tank farms) are often associated with pipeline projects, but are excluded. However, incidental valve, monitoring or pigging stations may be included. In any case, pipeline projects are often executed as part of a program that also involves node project scope or facility operational changes (or at least considerations for integrated system commissioning and startup). A key element of defining scope is to study system hydraulics and while station estimate classification is excluded in this RP, the design of pipeline and stations (which can vary in number and placement) are done iteratively [5]. As the definition states, a distinguishing feature of these projects is that they often traverse wide areas, cross country or subsea, which puts an emphasis on the definition of routing, land ownership and conditions, and establishing right-of-way (ROW). Associated scope definition challenges include defining stakeholder, permitting and regulatory requirements (pipeline transportation is usually a regulated industry if not government owned).

The main physical pipeline transportation scope elements are the pipe, fittings, valves and controls as well as associated items for road, rail, water and other crossings including horizontal drilled borings (tunneling is excluded). Surface pipelines also include structural supports. Main installation elements include land clearing if over land (including forestry if applicable), foundation and structure erection if on the surface, or trenching and backfill if buried, and pipe transport and handling, joining (i.e., welding), coating, cathodic protection, insulation and placement. Special scope elements are involved with crossings of water, road, rail and so on and at the pipeline terminations. Environmental, safety and health concerns are paramount with pipelines under pressure, and may carry hazardous materials, therefore, monitoring and control systems are key scope elements as well as inspection and maintenance considerations (e.g., pigging).

In general, the more developed the route, the more complex the installation will be. For urban areas, obstructions with utilities are frequent requiring existing condition studies, coordination with utilities and sometimes relocations. In remote locations and/or difficult or environmentally sensitive terrain, installation has its own challenges. Before any installation work can begin in an area, appropriate land and ROW must be acquired which creates unique scheduling as well as cost challenges.

For the purpose of estimate classification then, the main scope definition deliverables are associated with hydraulic design, defining the throughput capacity (volume/time), pipeline, fitting and control materials, and the routing including its elevation profiles, crossings and other elements. Pipelines materials can vary widely (e.g., steel, plastic, composite, etc.) as do coatings and insulation (if applicable). The pipeline material costs may be 20 to 40% of the total pipeline costs, making these projects highly susceptible to escalation and currency uncertainty. The route's land or subsea characteristics and the nature of developments drive the need for special design features and execution strategies. For each scope definition decision, stakeholder requirements need to be considered.

Pumping, compression, terminal and well site projects are usually associated with pipeline transportation projects. However, these facilities are equipment-centric and located on facility sites that have physical and defining characteristics similar to process plant projects (e.g., reliance on equipment lists, piping and instrumentation diagrams (P&IDs), plot plans, etc.). Therefore, RP 18R-97 for process plants is recommended for classifying those estimates [2]. Pipelines projects may also share right-of-ways with power transmission line projects that are covered in RP 96R-18 [6].

This guideline reflects generally-accepted cost engineering practices. This recommended practice was based upon the practices of multiple pipeline companies as well as published references and standards. Company and public standards were solicited and reviewed, and the practices were found to have significant commonalities. These classifications are also supported by empirical industry research of systemic risks and their correlation with cost growth and schedule slippage [7].

This RP applies to a variety of project delivery methods such as traditional design-bid-build (DBB), design-build (DB), construction management for fee (CM-fee), construction management at risk (CM-at risk), and private-public partnerships (PPP) contracting methods.

3. COST ESTIMATE CLASSIFICATION MATRIX FOR PIPELINE TRANSPORTATION INFRASTRUCTURE INDUSTRIES

A purpose of cost estimate classification is to align the estimating process with project stage-gate scope development and decision-making processes.

Table 1 provides a summary of the characteristics of the five estimate classes. The maturity level of project definition is the sole determining (i.e., primary) characteristic of class. In Table 1, the maturity is roughly indicated by a percentage of complete definition; however, it is the maturity of the defining deliverables that is the determinant, not the percent. The specific deliverables, and their maturity or status are provided in Table 3. The other characteristics are secondary and are generally correlated with the maturity level of project definition deliverables, as discussed in the generic RP. [1] Again, the characteristics are typical but may vary depending on the circumstances.

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	Primary Characteristic	***Secondary Characteristic***		
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges at an 80% confidence interval
Class 5	0% to 2%	Concept screening	Cost/length factors, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Cost/length, factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Table 1 – Cost Estimate Classification Matrix for the Pipeline Transportation Infrastructure Industries

This matrix and guideline outline an estimate classification system that is specific to the pipeline transportation infrastructure industries. Refer to the Recommended Practice 17R-97 [1] for a general matrix that is non-industry specific, or to other cost estimate classification RPs for guidelines that will provide more detailed information for application in other specific industries (e.g., 18R-97 for pumping, compression and terminal facilities [2]). These will provide additional information, particularly the *Estimate Input Checklist and Maturity Matrix* which determines the class in those industries. See Professional Guidance Document 01, *Guide to Cost Estimate Classification.* [8]

Table 1 illustrates typical ranges of accuracy ranges that are associated with the pipeline transportation infrastructure industries. The +/- value represents typical percentage variation at an 80% confidence interval of actual costs from the cost estimate after application of appropriate contingency (typically to achieve a 50% probability of project cost overrun versus underrun) for given scope. Depending on the technical and project deliverables (and other variables) and risks associated with each estimate, the accuracy range for any particular estimate is expected to fall within the ranges identified. However, this does not preclude a specific actual project result from falling outside of the indicated range of ranges identified in Table 1. In fact, research indicates that for weak project systems and complex or otherwise risky projects, the high ranges may be two to three times the high range indicated in Table 1. [9]

In addition to the degree of project definition, estimate accuracy is also driven by other systemic risks such as:

- Level of familiarity with technology and hydraulic conditions.
- Unique/remote nature of project locations and conditions and the availability of reference data for those.
- Complexity of the project and its execution.
- Quality of reference cost estimating data.
- Quality of assumptions used in preparing the estimate.
- Experience and skill level of the estimator.
- Estimating techniques employed.
- Time and level of effort budgeted to prepare the estimate.
- Market and pricing conditions.
- Currency exchange.

- Regulatory, community, landowner, and political risks.

Systemic risks such as these are often the primary driver of accuracy, especially during the early stages of project definition. As project definition progresses, project-specific risks (e.g. risk events and conditions) become more prevalent (or better known) and also drive the accuracy range.

Another concern in estimates is potential organizational pressure for a predetermined value that may result in a biased estimate. The goal should be to have an unbiased and objective estimate both for the base cost and for contingency. The stated estimate ranges are dependent on this premise and a realistic view of the project. Failure to appropriately address systemic risks (e.g. technical complexity) during the risk analysis process, impacts the resulting probability distribution of the estimated costs, and therefore the interpretation of estimate accuracy.

Figure 1 illustrates the general relationship trend between estimate accuracy and the estimate classes (corresponding with the maturity level of project definition). Depending upon the technical complexity of the project, the availability of appropriate cost reference information, the degree of project definition, and the inclusion of appropriate contingency determination, a typical Class 5 estimate for a pipeline transportation industry project may have an accuracy range as broad as -50% to +100%, or as narrow as -20% to +30%. However, note that this is dependent upon the contingency included in the estimate appropriately quantifying the uncertainty and risks associated with the cost estimate. Refer to Table 1 for the accuracy ranges conceptually illustrated in Figure 1. [10]

Figure 1 also illustrates that the estimating accuracy ranges overlap the estimate classes. There are cases where a Class 5 estimate for a particular project may be as accurate as a Class 3 estimate for a different project. For example, similar accuracy ranges may occur if the Class 5 estimate of one project that is based on a repeat project with good cost history and data and, whereas the Class 3 estimate for another is for a project involving new technology. It is for this reason that Table 1 provides ranges of accuracy values. This allows consideration of the specific circumstances inherent in a project and an industry sector to provide realistic estimate class accuracy range percentages. While a target range may be expected for a particular estimate, the accuracy range should always be determined through risk analysis of the specific project and should never be pre-determined. AACE has recommended practices that address contingency determination and risk analysis methods. [11]

If contingency has been addressed appropriately approximately 80% of projects should fall within the ranges shown in Figure 1. However, this does not preclude a specific actual project result from falling inside or outside of the indicated range of ranges identified in Table 1. As previously mentioned, research indicates that for weak project systems, and/or complex or otherwise risky projects, the high ranges may be two to three times the high range indicated in Table 1.

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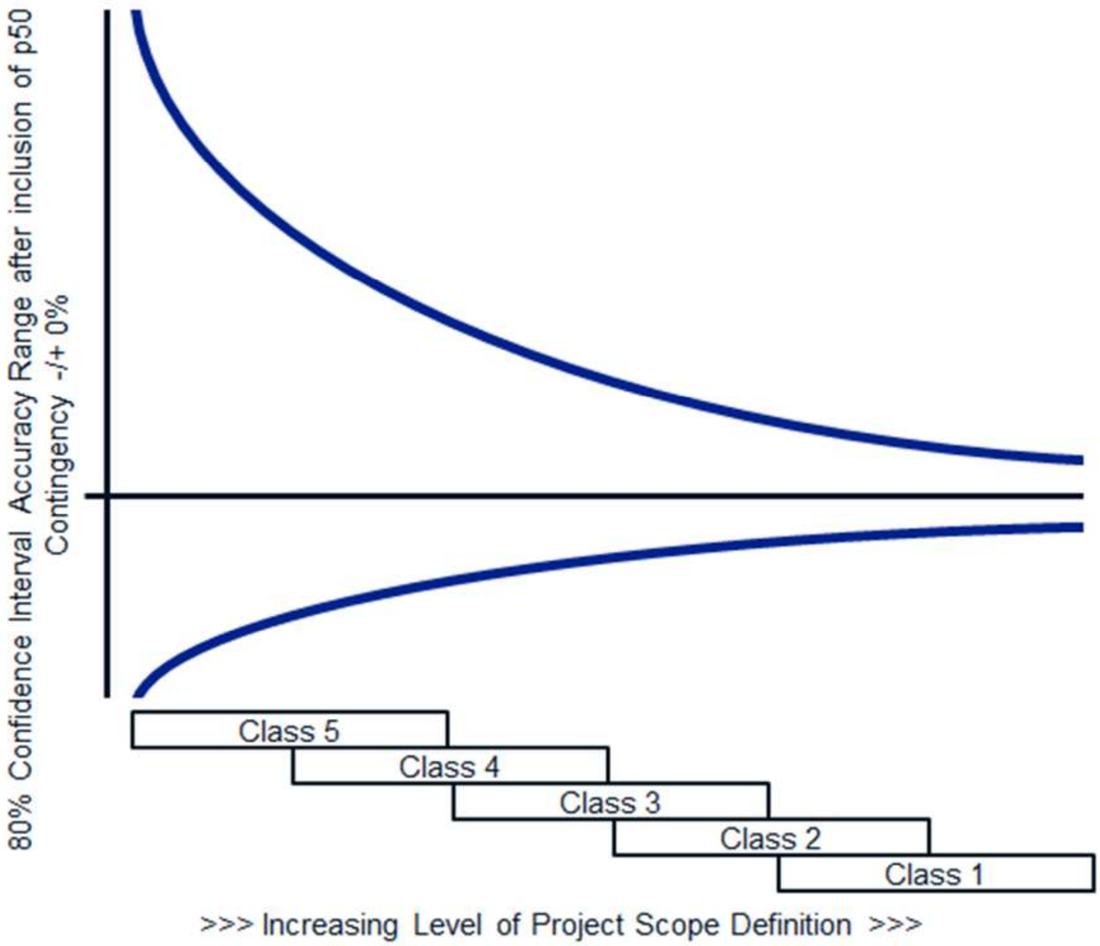

Figure 1 – Illustration of the Variability in Accuracy Ranges for Pipeline Transportation Infrastructure Industry Estimates

4. DETERMINATION OF THE COST ESTIMATE CLASS

For a given project, the determination of the estimate class is based upon the maturity level of project definition based on the status of specific key planning and design deliverables. The percent design completion may be correlated with the status, but the percentage should not be used as the class determinate. While the determination of the status (and hence the estimate class) is somewhat subjective, having standards for the design input data, completeness and quality of the design deliverables will serve to make the determination more objective.

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5. CHARACTERISTICS OF THE ESTIMATE CLASSES

The following tables (2a through 2e) provide detailed descriptions of the five estimate classifications as applied in the pipeline transportation infrastructure industries. They are presented in the order of least-defined estimates to the most-defined estimates. These descriptions include brief discussions of each of the estimate characteristics that define an estimate class.

For each table, the following information is provided:

- **Description:** A short description of the class of estimate, including a brief listing of the expected estimate inputs based on the maturity level of project definition deliverables.

- **Maturity Level of Project Definition Deliverables (Primary Characteristic):** Describes a particularly key deliverable and a typical target status in stage-gate decision processes, plus an indication of approximate percent of full definition of project and technical deliverables. Typically, but not always, maturity level correlates with the percent of engineering and design complete.

- **End Usage (Secondary Characteristic):** A short discussion of the possible end usage of this class of estimate.

- **Estimating Methodology (Secondary Characteristic):** A listing of the possible estimating methods that may be employed to develop an estimate of this class.

- **Expected Accuracy Range (Secondary Characteristic):** Typical variation in low and high ranges after the application of contingency (determined at a 50% level of confidence). Typically, this represents about 80% confidence that the actual cost will fall within the bounds of the low and high ranges if contingency appropriately forecasts uncertainty and risks.

- **Alternate Estimate Names, Terms, Expressions, Synonyms:** This section provides other commonly used names that an estimate of this class might be known by. These alternate names are not endorsed by this recommended practice. The user is cautioned that an alternative name may not always be correlated with the class of estimate as identified in Tables 2a-2e.

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CLASS 5 ESTIMATE	
Description: Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. As such, some companies and organizations have elected to determine that due to the inherent inaccuracies, such estimates cannot be classified in a conventional and systematic manner. Class 5 estimates, due to the requirements of end use, may be prepared within a very limited amount of time and with little effort expended—sometimes requiring less than an hour to prepare. Often, little more than the proposed throughput capacity, pipe diameter and length over approximate alternate routes on large scale maps is known at the time of estimate preparation. **Maturity Level of Project Definition Deliverables:** Key deliverable and target status: Pipeline throughput capacity, general design concepts and routing alternatives agreed by business stakeholders. 0% to 2% of full project definition. **End Usage:** Class 5 estimates are prepared for any number of strategic business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, routing studies, evaluation of resource needs and budgeting, long-range capital planning, etc.	**Estimating Methodology:** Class 5 estimates generally use stochastic estimating methods such as gross unit costs (cost/length), factoring and other parametric and modeling techniques. **Expected Accuracy Range:** Typical accuracy ranges for Class 5 estimates are -20% to -50% on the low side, and +30% to +100% on the high side, depending on the technological and route complexity, and appropriate reference information and other risks (after inclusion of an appropriate contingency determination). Ranges could exceed those shown if there are unusual risks including volatile commodity markets and escalation (i.e., because of the proportion of commodity material content such as steel). The range values will shift (show bias) to the extent that contingency included in the funding is over or underestimated. **Alternate Estimate Names, Terms, Expressions, Synonyms:** Ballpark, conceptual, gross, blue sky, seat-of-pants, rough order of magnitude (ROM), screening, idea study, indicative, scoping, prospect estimate, guesstimate, rule-of-thumb.

Table 2a – Class 5 Estimate

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CLASS 4 ESTIMATE	
Description: Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 15% complete, and would comprise at a minimum the following: throughput capacity, preliminary hydraulic design, pipe type and diameter, route topographic mapping with aerial photography, preliminary crossing and control features identified, and major environmental, community, regulatory and ROW concerns identified. **Maturity Level of Project Definition Deliverables:** Key deliverable and target status: Preliminary hydraulic design, routing corridors defined with optimization underway, with preliminary crossing and major valve identification and assumed geotechnical conditions. 1% to 15% of full project definition. **End Usage:** Class 4 estimates are prepared for a number of purposes, such as but not limited to, detailed strategic planning, business development, project screening at more developed stages, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget approval or approval to proceed to next stage or to establish binding contracts with shippers.	**Estimating Methodology:** Class 4 estimates generally use stochastic estimating methods such as adjusted gross unit costs (cost/length) with adjustment for specific design elements or approximate unit or assembly costs for major crossings, controls and other major elements, factored design and installation costs, and other parametric and modeling techniques. **Expected Accuracy Range:** Typical accuracy ranges for Class 4 estimates are -15% to -30% on the low side, and +20% to +50% on the high side, depending on the technological and route complexity, and appropriate reference information and other risks (after inclusion of an appropriate contingency determination). Ranges could exceed those shown if there are unusual risks including volatile commodity markets and escalation (i.e., because of the proportion of commodity material content such as steel). The range values will shift (show bias) to the extent that contingency included in the funding is over or underestimated. **Alternate Estimate Names, Terms, Expressions, Synonyms:** Top-down, feasibility, factored, pre-design, advanced study, basic engineering, planning, preliminary funding, concession license.

Table 2b – Class 4 Estimate

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CLASS 3 ESTIMATE	
Description: Class 3 estimates are generally prepared to form the basis for budget authorization, appropriation, and/or funding. As such, they typically form the initial control estimate against which all actual costs and resources will be monitored. Typically, engineering is from 10% to 40% complete, and would comprise at a minimum the following: completed hydraulic study, completed geotechnical study, confirmed optimized route, specific pipe and control materials, long lead orders ready to be placed, controls and supervisory control and data acquisition (SCADA) defined, specific crossings known. Quantities are identified at a reasonable level of detail. ROW title holders defined and negotiation in progress, and regulatory, permitting and stakeholder concerns addressed. Adequate definition to obtain firm construction bid unit pricing with execution and contracting plans defined. **Maturity Level of Project Definition Deliverables:** Key deliverable and target status: Completed hydraulic study, completed geotechnical study, route conditions confirmed by survey; pipe, coatings, valves and crossings defined; long lead pipe quoted and ready to order, all ROW title holders identified and ready to begin negotiations, major permit applications prepared, license applications and environmental impact statement (EIS) prepared, and execution plans agreed. 10% to 40% of full project definition. **End Usage:** Class 3 estimates are typically prepared to support full project funding requests and become the first of the project phase control estimates against which all actual costs and resources will be monitored for variations to the budget. They are used as the project control budget until replaced by more detailed estimates. In many owner organizations, a Class 3 estimate is often the last estimate required and could very well form the only basis for cost/schedule control.	**Estimating Methodology:** Class 3 estimates generally involve more deterministic estimating methods than stochastic methods. They usually involve predominant use of unit cost line items, although these may be at an assembly level of detail rather than individual components. Factoring and other stochastic methods may be used to estimate less-significant areas of the project. **Expected Accuracy Range:** Typical accuracy ranges for Class 3 estimates are -10% to -20% on the low side, and +10% to +30% on the high side, depending on the technological and route complexity, and appropriate reference information and other risks (after inclusion of an appropriate contingency determination). Ranges could exceed those shown if there are unusual risks including volatile commodity markets and escalation (i.e., because of the proportion of commodity material content such as steel). However, projects in existing, developed ROW may have tighter ranges. The range values will shift (show bias) to the extent that contingency included in the funding is over or underestimated. **Alternate Estimate Names, Terms, Expressions, Synonyms:** Budget, scope, sanction, semi-detailed, forced detail, authorization, preliminary control, front-end engineering and design (FEED), target estimate, concession license, bid, tender.

Table 2c – Class 3 Estimate

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CLASS 2 ESTIMATE	
Description: Class 2 estimates are generally prepared to form a detailed contractor control baseline (and update the owner control baseline) against which all project work is monitored in terms of cost and progress control. For contractors, this class of estimate is often used as the bid estimate to establish contract value. Typically, engineering is from 30% to 75% complete, and would comprise at a minimum the following: pipe and valves ordered and fabrication begun, final routing, specific crossing designs, most ROW obtained, permits and licenses obtained, contracts in place and construction in progress. **Maturity Level of Project Definition Deliverables:** Key deliverable and target status: Specific route conditions surveyed, specific crossing designs; most ROW, permits, and licenses obtained; and supply and installation contracts issued. 30% to 75% of full project definition. **End Usage:** Class 2 estimates are typically prepared as the detailed contractor control baseline (and update the owner control baseline) against which all actual costs and resources will now be monitored for variations to the budget and form a part of the change management program.	**Estimating Methodology:** Class 2 estimates generally involve a high degree of deterministic estimating methods. Class 2 estimates are prepared in great detail, and often involve tens of thousands of unit cost line items. For those areas of the project still undefined, an assumed level of detail takeoff (forced detail) may be developed to use as line items in the estimate instead of relying on factoring methods. **Expected Accuracy Range:** Typical accuracy ranges for Class 2 estimates are -5% to -15% on the low side, and +5% to +20% on the high side, depending on the technological and route complexity, and appropriate reference information and other risks (after inclusion of an appropriate contingency determination). Ranges could exceed those shown if there are unusual risks. The range values will shift (show bias) to the extent that contingency included in the funding is over or underestimated. **Alternate Estimate Names, Terms, Expressions, Synonyms:** Detailed control, execution phase, master control, engineering, tender, change order estimate.

Table 2d – Class 2 Estimate

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CLASS 1 ESTIMATE	
Description: Class 1 estimates are generally prepared for discrete parts or sections of the total project rather than generating this level of detail for the entire project. The parts of the project estimated at this level of detail will typically be used by subcontractors for bids, or by owners for check estimates. The updated estimate is often referred to as the current control estimate and becomes the new baseline for cost/schedule control of the project. Class 1 estimates may be prepared for parts of the project to comprise a fair price estimate or bid check estimate to compare against a contractor's bid estimate, or to evaluate/dispute change orders and claims. Typically, overall engineering is from 65% to 100% complete (some parts or packages may be complete and others not) and would comprise virtually all engineering and design documentation of the project, and complete project execution and commissioning plans. **Maturity Level of Project Definition Deliverables:** Key Deliverable and Target Status: All deliverables in the maturity matrix complete. 65% to 100% of full project definition. **End Usage:** Generally, owners and EPC contractors use Class 1 estimates to support their change management process. They may be used to evaluate bid checking, to support vendor/contractor negotiations, or for claim evaluations and dispute resolution. Construction contractors may prepare Class 1 estimates to support their bidding and to act as their final control baseline against which all actual costs and resources will now be monitored for variations to their bid. During construction, Class 1 estimates may be prepared to support change management.	**Estimating Methodology:** Class 1 estimates generally involve the highest degree of deterministic estimating methods and require the greatest amount of effort. Class 1 estimates are prepared in great detail, and thus are usually performed on only the most important or critical areas of the project. All items in the estimate are usually unit cost line items based on actual design quantities. **Expected Accuracy Range:** Typical accuracy ranges for Class 1 estimates are -3% to -10% on the low side, and +3% to +15% on the high side, depending on the technological and route complexity, and appropriate reference information and other risks (after inclusion of an appropriate contingency determination). Ranges could exceed those shown if there are unusual risks. The range values will shift (show bias) to the extent that contingency included in the funding is over or underestimated. **Alternate Estimate Names, Terms, Expressions, Synonyms:** Full detail, release, fall-out, tender, firm price, bottoms-up, final, detailed control, forced detail, execution phase, master control, fair price, definitive, change order estimate.

Table 2e – Class 1 Estimate

6. ESTIMATE INPUT CHECKLIST AND MATURITY MATRIX

Table 3 maps the extent and maturity of estimate input information (deliverables) against the five estimate classification levels. This is a checklist of basic deliverables found in common practice in the pipeline transportation infrastructure industries. The maturity level is an approximation of the completion status of the deliverable. The degree of completion is indicated by the following descriptors:

General Project Data:

- **Not Required (NR):** May not be required for all estimates of the specified class, but specific project estimates may require at least preliminary development.

- **Preliminary (P)**: Project definition has begun and progressed to at least an intermediate level of completion. Review and approvals for its current status has occurred.

- **Defined (D)**: Project definition is advanced, and reviews have been conducted. Development may be near completion with the exception of final approvals.

Technical Deliverables:

- **Not Required (NR)**: Deliverable may not be required for all estimates of the specified class, but specific project estimates may require at least preliminary development.

- **Started (S):** Work on the deliverable has begun. Development is typically limited to sketches, rough outlines, or similar levels of early completion.

- **Preliminary (P):** Work on the deliverable is advanced. Interim, cross-functional reviews have usually been conducted. Development may be near completion except for final reviews and approvals.

- **Complete (C):** The deliverable has been reviewed and approved as appropriate.

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MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES	ESTIMATE CLASSIFICATION				
	CLASS 5	CLASS 4	CLASS 3	CLASS 2	CLASS 1
	0% to 2%	1% to 15%	10% to 40%	30% to 75%	65% to 100%
GENERAL PROJECT DATA:					
A. SCOPE:					
Project Scope of Work Description	P	P	D	D	D
Site Infrastructure (Access, Construction Power, Camp etc.)	NR	P	D	D	D
B. CAPACITY:					
Flow and Commodity Characteristics	P	P	D	D	D
Electrical Power Requirements (when not the primary capacity driver)	NR	P	D	D	D
C. PROJECT LOCATION:					
Station, Terminal and Tie-in	P	P	D	D	D
D. REQUIREMENTS:					
Codes and/or Standards	NR	P	D	D	D
Communication Systems	NR	P	D	D	D
Environmental Monitoring	NR	NR	P	P	D
E. TECHNOLOGY SELECTION:					
N/A					
F. STRATEGY:					
Right-of Way (ROW)	P	P	D	D	D
Contracting / Sourcing	NR	P	D	D	D
Escalation	NR	P	D	D	D
G. PLANNING:					
Logistics Plan	P	P	P	D	D
Integrated Project Plan[1]	NR	P	D	D	D
Project Code of Accounts	NR	P	D	D	D
Project Master Schedule	NR	P	D	D	D
Regulatory Approval & Permitting	NR	P	D	D	D
Risk Register	NR	P	D	D	D
Stakeholder Consultation / Engagement / Management Plan	NR	P	D	D	D
Utility Coordination / Agreements	NR	P	D	D	D
Work Breakdown Structure	NR	P	D	D	D
Startup and Commissioning Plan	NR	P	P/D	D	D

[1] The integrated project plan (IPP), project execution plan (PEP), project management plan (PMP), or more broadly the project plan, is a high-level management guide to the means, methods and tools that will be used by the team to manage the project. The term integration emphasizes a project life cycle view (the term execution implying post-sanction) and the need for alignment. The IPP covers all functions (or phases) including engineering, procurement, contracting strategy, fabrication, construction, commissioning and startup within the scope of work. However, it also includes stakeholder management, safety, quality, project controls, risk, information, communication and other supporting functions. In respect to estimate classification, to be rated as *defined*, the IPP must cover all the relevant phases/functions in an integrated manner aligned with the project charter (i.e., objectives and strategies); anything less is *preliminary*. The overall IPP cannot be rated as *defined* unless all individual elements are defined and integrated.

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MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES	ESTIMATE CLASSIFICATION				
	CLASS 5	**CLASS 4**	**CLASS 3**	**CLASS 2**	**CLASS 1**
	0% to 2%	**1% to 15%**	**10% to 40%**	**30% to 75%**	**65% to 100%**
GENERAL PROJECT DATA:					
H. STUDIES:					
Routing Options	**P**	**P**	**D**	**D**	**D**
Topography and/or Bathymetry	**P**	**P**	**P/D**	**D**	**D**
Environmental Impact / Sustainability Assessment	**NR**	**P**	**D**	**D**	**D**
Environmental / Existing Conditions	**NR**	**P**	**D**	**D**	**D**
Meteorology and/or Oceanographic / Subsea	**NR**	**P**	**D**	**D**	**D**
Soils and Hydrology	**NR**	**P**	**D**	**D**	**D**
TECHNICAL DELIVERABLES:					
Hydraulic Design	**S**	**P**	**C**	**C**	**C**
Piping Discipline Drawings	**S**	**P**	**P**	**C**	**C**
Piping Schedules	**S**	**P**	**P**	**C**	**C**
Route Alignment Sheets	**S/P**	**P/C**	**C**	**C**	**C**
Route Mapping / Survey	**S/P**	**P/C**	**C**	**C**	**C**
Design Specifications	**NR**	**S/P**	**C**	**C**	**C**
Electrical One-Line Drawings	**NR**	**S/P**	**C**	**C**	**C**
Instrument List	**NR**	**S/P**	**C**	**C**	**C**
Utilities Systems Plans including Relocation	**NR**	**S/P**	**C**	**C**	**C**
Construction Permits	**NR**	**S/P**	**P/C**	**C**	**C**
Geometric Layout. Alignment, Profile, Cross Section	**NR**	**S/P**	**P/C**	**C**	**C**
Land / ROW Title Negotiation	**NR**	**S/P**	**P/C**	**C**	**C**
Civil / Site / Structural / Architectural Discipline Drawings	**NR**	**S/P**	**P**	**C**	**C**
Crossings and Borings Designs and Drawings	**NR**	**S/P**	**P**	**C**	**C**
Demolition Plan and Drawings	**NR**	**S/P**	**P**	**C**	**C**
Erosion Control Plan and Drawings	**NR**	**S/P**	**P**	**C**	**C**
Station / Terminal Interface Design	**NR**	**S**	**P**	**C**	**C**
Electrical Schedules	**NR**	**NR/S**	**P**	**P/C**	**C**
Instrument and Control Schedules	**NR**	**NR/S**	**P**	**P/C**	**C**
Instrument Datasheets	**NR**	**NR/S**	**P**	**P/C**	**C**
Electrical Discipline Drawings	**NR**	**NR**	**S/P**	**P/C**	**C**
Instrumentation / Control System Discipline Drawings	**NR**	**NR**	**S/P**	**P/C**	**C**

Table 3 – Estimate Input Checklist and Maturity Matrix (Primary Classification Determinate)

7. BASIS OF ESTIMATE DOCUMENTATION

The basis of estimate (BOE) typically accompanies the cost estimate. The basis of estimate is a document that describes how an estimate is prepared and defines the information used in support of development. A basis document commonly includes, but is not limited to, a description of the scope included, methodologies used, references and defining deliverables used, assumptions and exclusions made, clarifications, adjustments, and some indication of the level of uncertainty.

The BOE is, in some ways, just as important as the estimate since it documents the scope and assumptions; and provides a level of confidence to the estimate. The estimate is incomplete without a well-documented basis of estimate. See AACE Recommended Practice 34R-05 *Basis of Estimate* for more information. [12]

8. PROJECT DEFINITION RATING SYSTEM

An additional step in documenting the maturity level of project definition is to develop a project definition rating system. This is another tool for measuring the completeness of project scope definition. Such a system typically provides a checklist of scope definition elements and a scoring rubric to measure maturity or completeness for each element. A better project definition rating score is typically associated with a better probability of achieving project success.

Such a tool should be used in conjunction with the AACE estimate classification system; it does not replace estimate classification. A key difference is that a project definition rating measures overall maturity across a broad set of project definition elements, but it usually does not ensure completeness of the key project definition deliverables required to meet a specific class of estimate. For example, a good project definition rating may sometimes be achieved by progressing on additional project definition deliverables, but without achieving signoff or completion of a key deliverable.

AACE estimate classification is based on ensuring that key project deliverables have been completed or met the required level of maturity. If a key deliverable that is indicated as needing to be complete for Class 3 (as an example) has not actually been completed, then the estimate cannot be regarded as Class 3 regardless of the maturity or progress on other project definition elements.

An example of a project definition rating system is the *Project Definition Rating Index* developed by the Construction Industry Institute. It has developed several indices for specific industries, such as IR113-2 [13] for the process industry and IR115-2 [14] for the building industry. Similar systems have been developed by the US Department of Energy. [15]

9. CLASSIFICATION FOR LONG-TERM PLANNING AND ASSET LIFE CYCLE COST ESTIMATES

As stated in the Purpose section, classification maps the phases and stages of project cost estimating. Typically, in a phase-gate project system, scope definition and capital cost estimating activities flow from framing a business opportunity through to a capital investment decision and eventual project completion in a more-or-less steady, short-term (e.g., several years) project life-cycle process.

Cost estimates are also prepared to support long-range (e.g., perhaps several decades) capital budgeting and/or asset life cycle planning. Asset life cycle estimates are also prepared to support net present value (e.g., estimates for initial capital project, sustaining capital, and decommissioning projects), value engineering and other cost or economic studies. These estimates are necessary to address sustainability as well. Typically, these long-range estimates are based on minimal scope definition as defined for *Class 5*. However, these asset life cycle "conceptual" estimates are prepared so far in advance that it is virtually assured that the scope will change from even the minimal level of definition assumed at the time of the estimate. Therefore, the expected estimate accuracy values reported in Table 1 (percent that actual cost will be over or under the estimate including contingency) are not meaningful because the Table 1 accuracy values explicitly *exclude scope change*. For long-term estimates, one of the following two classification approaches is recommended:

- If the long-range estimate is to be updated or maintained periodically in a controlled, documented life cycle process that addresses scope and technology changes in estimates over time (e.g., nuclear or other licensing may require that future decommissioning estimates be periodically updated), the estimate is rated as *Class 5* and the Table 1 accuracy ranges are assumed to apply for the specific scope included in the estimate at the time of estimate preparation. Scope changes are explicitly excluded from the accuracy range.

- If the long-range estimate is performed as part of a process or analysis where scope and technology change is not expected to be addressed in routine estimate updates over time, the estimate is rated as *Unclassified* or as *Class 10* (if a class designation is required to meet organizational procedures)*,* and the Table 1 accuracy ranges cannot be assumed to apply. The term *Class 10* is specifically used to distinguish these long-range estimates from the relatively short time-frame *Class 5* through *Class 1* capital cost estimates identified in Table 1 and this RP; and to indicate the order-of-magnitude difference in potential expected estimate accuracy due to the infrequent updates for scope and technology. Unclassified (or Class 10) estimates are not associated with indicated expected accuracy ranges.

In all cases, a *Basis of Estimate* should be documented so that the estimate is clearly understood by those reviewing and/or relying on them later. Also, the estimating methods and other characteristics of Class 5 estimates generally apply. In other words, an *Unclassified* or *Class 10* designation must not be used as an excuse for unprofessional estimating practice.

REFERENCES

[1] AACE International, Recommended Practice No. 17R-97, Cost Estimate Classification System, Morgantown, WV: AACE International, Latest revision.

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[13] Construction Industry Institute (CII), "PDRI: Project Definition Rating Index – Industrial Projects, Version 3.2 (113-2)," Construction Industry Institute (CII), Austin, 2009.

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[15] U.S. Department of Energy (DOE), "Project Definition Rating Index Guide for Traditional Nuclear and Non-Nuclear Construction Projects, DOE G 413.3-12," U.S. Department of Energy (DOE), 2010.

[16] B. Kitson, "Developing and Calibrating a Cost Estimating Toolset: An Owner's Experience," in *AACE International Transactions*, Morgantown, 2011.

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APPENDIX: UNDERSTANDING ESTIMATE CLASS AND COST ESTIMATE ACCURACY

Despite the verbiage included in the RP, often, there are still misunderstandings that the class of estimate, as defined in the RP above, defines an expected accuracy range for each estimate class. This is incorrect. The RP clearly states that "while a target range may be expected for a particular estimate, the accuracy range should always be determined through risk analysis of the specific project and should never be predetermined." Table 1 and Figure 1 in the RP are intended to illustrate only the general relationship between estimate accuracy and the level of project definition. For the pipeline transportation infrastructure industries, typical estimate ranges described in RP 97R-18 above are shown as a range of ranges:

- Class 5 Estimate:
  - High range typically ranges from +30% to +100%
  - Low range typically ranges from -20% to -50%
- Class 4 Estimate:
  - High range typically ranges from +20% to +50%
  - Low range typically ranges from -15% to -30%
- Class 3 Estimate:
  - High range typically ranges from +10% to +30%
  - Low range typically ranges from -10% to -20%
- Class 2 Estimate:
  - High range typically ranges from +5% to +20%
  - Low range typically ranges from -5% to -15%
- Class 1 Estimate:
  - High range typically ranges from +3% to +15%
  - Low range typically ranges from -3% to -10%

As indicated in the RP, these +/- percentage members associated with an estimate class are intended as rough indicators of the accuracy relationship. They are merely a useful simplification given the reality that every individual estimate will be associated with a unique probability distribution correlated with its specific level of uncertainty. As indicated in the RP, estimate accuracy should be determined through a risk analysis for each estimate.

It should also be noted that there is no indication in the RP of contingency determination being based on the class of estimate. AACE has recommended practices that address contingency determination and risk analysis methods (for example RP 40R-08, *Contingency Estimating – General Principles* [16]). Furthermore, the level of contingency required for an estimate is not the same as the upper limits of estimate accuracy (as determined by a risk analysis).

The results of the estimating process are often conveyed as a single value of cost or time. However, since estimates are predications of an uncertain future, it is recommended that all estimate results should be presented as a probabilistic distribution of possible outcomes in consideration of risk.

Every estimate is a prediction of the expected final cost or duration of a proposed project or effort (for a given scope of work). By its nature, an estimate involves assumptions and uncertainties. Performing the work is also subject to risk conditions and events that are often difficult to identify and quantify. Therefore, every estimate presented as a single value of cost or duration will likely deviate from the final outcome (i.e., statistical error). In simple terms, this means that every point estimate value will likely prove to be wrong. Optimally, the estimator will analyze the uncertainty and risks and produce a probabilistic estimate that provides decision makers with the probabilities of over-running or under-running any particular cost or duration value. Given this probabilistic nature of an estimate, an estimate should not be regarded as a single point cost or duration. Instead, an estimate actually reflects a range of potential outcomes, with each value within this range associated with a probability of occurrence.

Individual estimates should always have their accuracy ranges determined by a quantitative risk analysis study that results in an estimate probability distribution. The estimate probability distribution is typically skewed. Research shows the skew is typically to the right (positive skewness with a longer tail to the right side of the distribution) for large and complex projects. In part, this is because the impact of risk is often unbounded on the high side.

High side skewness implies that there is potential for the high range of the estimate to exceed the median value of the probability distribution by a higher absolute value than the difference between the low range of the estimate and the median value of the distribution.

Figure A1 shows a positively skewed distribution for a sample cost estimate risk analysis that has a point base estimate (the value before adding contingency) of $89.5. In this example, a contingency of $4.5 (approximately 5%) is required to achieve a 50% probability of underrun, which increases the final estimate value after consideration of risk to $93. Note that this example is intended to describe the concepts but not to recommend specific confidence levels for funding contingency or management reserves of particular projects; that depends on the stakeholder risk attitude and tolerance.

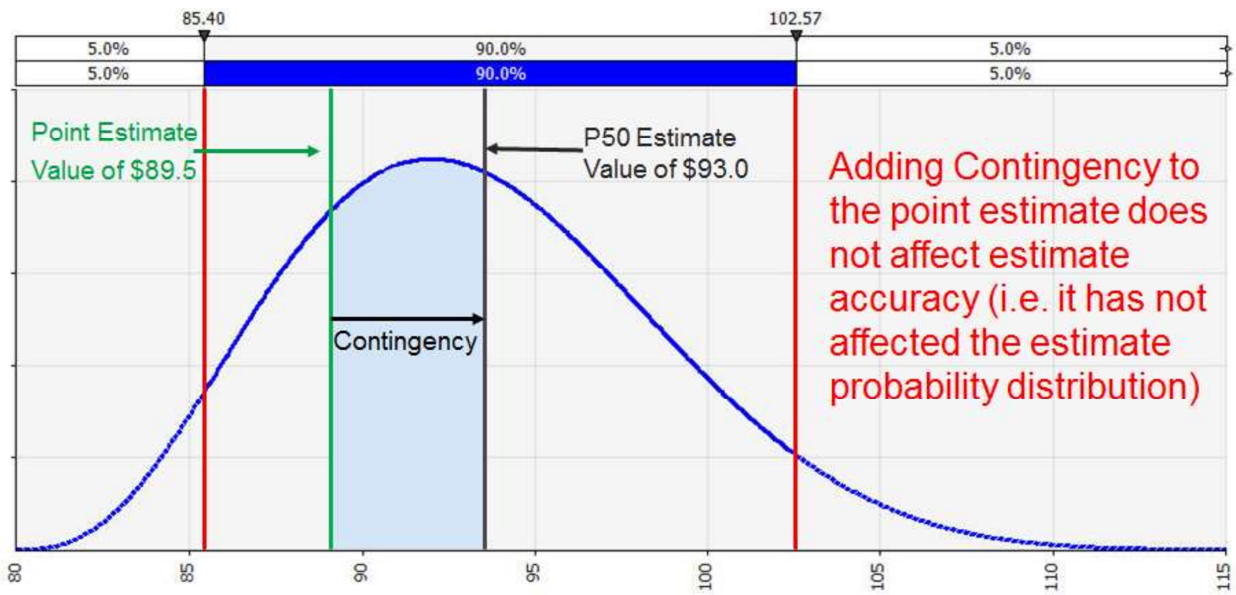

Figure – A1: Example of an Estimate Probability Distribution at a 90% Confidence Interval

Note that adding contingency to the base point estimate does not affect estimate accuracy in absolute terms as it has not affected the estimate probability distribution (i.e., high and low values are the same). Adding contingency simply increases the probability of underrunning the final estimate value and decreases the probability of overrunning the final estimate value. In this example, the estimate range with a 90% confidence interval remains between approximately $85 and $103 regardless of the contingency value.

As indicated in the RP, expected estimate accuracy tends to improve (i.e., the range of probable values narrows) as the level of project scope definition improves. In terms of the AACE International estimate classifications, increasing levels of project definition are associated with moving from Class 5 estimates (lowest level of scope definition) to Class 1 estimates (highest level of scope definition), as shown in Figure 1 of the RP. Keeping in mind that accuracy is an expression of an estimate's predicted closeness to the final actual value; anything included in that final actual cost, be it the result of general uncertainty, risk conditions and events, price escalation, currency or anything else within the project scope, is something that estimate accuracy measures must communicate in some manner. With that in mind, it should be clear why standard accuracy range values are not applicable to individual estimates.

The level of project definition reflected in the estimate is a key risk driver and hence is at the heart of estimate classification, but it is not the only driver of estimate risk and uncertainty. Given all the potential sources of risk and uncertainty that will vary for each specific estimate, it is simply not possible to define a range of estimate accuracy solely based on the level of project definition or class of estimate.

APPENDIX C

SoCalGas's Response to Data Request PAO-SCG-107-JOH-Q1

Data Request Number: PAO-SCG-107-JOH

Proceeding Name: A2205015_016 - SoCalGas and SDGE 2024 GRC

Publish To: Public Advocates Office

Date Received: 2/6/2023

Date Responded: 2/21/2023

1. The table below summarizes the difference between the Jan 17, 2023 RO model rbSCGDataInput/Input spreadsheet (for witness Kostelnik), and the SCG-08 testimony capital summary on page SCG-08 BGK-iv.

Please reconcile the difference and identify the specific line items in the RO that agree with the summary table in SCG-08 p. BGK-iv.

	2022	2023	2024
Jan 17, 2023 RO	204,358	139,396	111, 862
SCG-08 p. BGK-iv	141,509	101,920	73,810
Difference	62,849	37,476	38,052

SoCalGas Response 1:

The difference between the table in Exhibit SCG-08 and the January 17, 2023 RO model represents the PSEP capital projects with in-service dates after test-year 2024 (after December 31, 2024). These projects are included in the RO model so they receive the appropriate overhead loading during construction. However, they are not included in the 2024 test-year revenue requirement request because the in-service date is after the 2024 test year. Also, a portion of the difference is a duplicated line item associated with the PSEP valve enhancement plan that was incorrectly included and identified as having a post-test year in-service date. This amount will be removed from the RO model at the next available opportunity.

	2022	**2023**	**2024**	**RO Location**
Jan 17, 2023 RO	204,358	139,396	111, 862	Rows 10-19, 21-30, 32-40, 42-43
SCG-08 p. BGK-iv	141,509	101,920	73,810	
Difference	62,849	37,476	38,052	Rows 298-308, 311-313, 315-318