

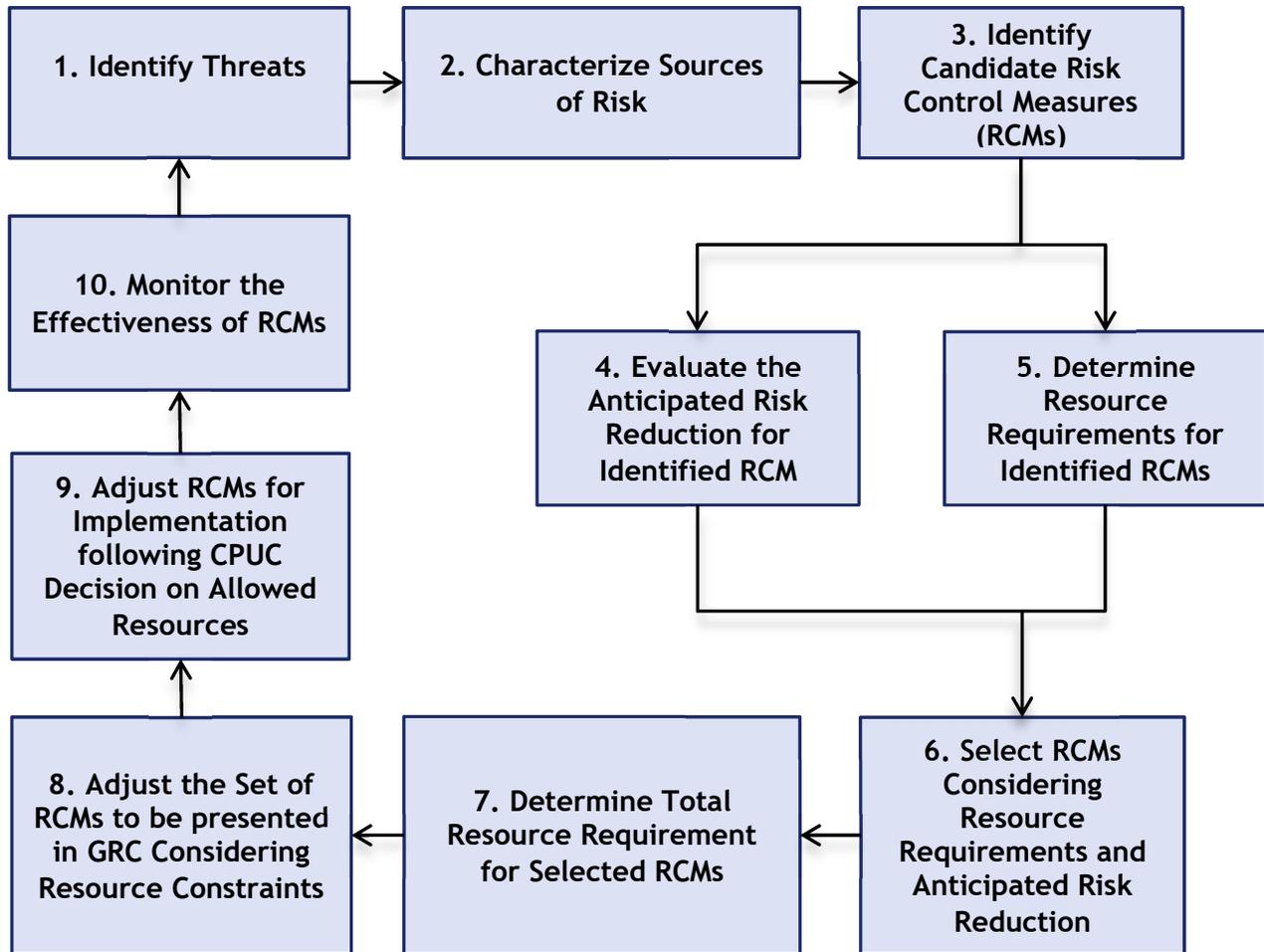
Cycla's original 10-steps process as it originally appeared as Attachment 3 in the
May 16, 2013 report prepared by Cycla Corporation:
Evaluation of PG&E's 2014 Gas Distribution GRC Filing

Attachment 3 - Evaluation Criteria for a General Rate Case Filing

As the basis for this evaluation, Cycla Corporation has developed a comprehensive set of criteria, based on widely accepted international risk management standards, against which PG&E's risk management program was evaluated. These criteria have provides the basis for the current evaluation and should be used to guide future development of processes and tools for use in developing rate case filings. The standards and supporting material considered in developing the evaluation criteria are presented in Attachment 2.

Figure 3-1 describes the ten process elements involved in a risk-informed resource allocation process. Such a process is the recommended way for an operator to develop the basis for and justify the necessity and reasonableness of risk control measures (RCMs) it includes in a General Rate Case filing. A set of criteria for each of these ten process elements is presented below. These criteria are appropriate for guiding the development of the operator's rate case filing and for use by the CPUC in evaluating the content of a GRC filing.

Figure 3-1 Elements of a Risk-Informed Resource Allocation Process



These ten elements comprise the key sequence of steps in a risk-informed resource allocation process.

As shown in Figure 3-1, the ten process elements include:

1. Identify the threats having the potential to lead to safety risk;
2. Characterize the sources of risk;
3. Characterize the candidate measures for controlling risk;
4. Characterize the effectiveness of the candidate risk control measures (RCMs); in parallel with
5. Prepare initial estimates of the resources required to implement and maintain candidate RCMs;
6. Select RCMs the operator wishes to implement (based on anticipated effectiveness and costs associated with candidate RCMs);
7. Determine the total resource requirements for selected RCMs;
8. Adjust the set of selected RCMs based on real-world constraints such as availability of qualified people to perform the necessary work;

9. Document and submit the General Rate Case filing, on which the CPUC decides the expenditures it will allow, and, based on CPUC decision, adjust the operator's implementation plan;
10. Monitor the effectiveness of the implemented RCMs and, based on lessons learned, begin the process again.

One subtlety in this process is that the plan reviewed and approved by the CPUC typically includes funds allocated to one or more sets of control measures for which implementation details are decided by the operator as part of an annual planning process (e.g., exactly which segments to replace within an overall plan to replace a specified amount of the highest risk pipe). These operating decisions can and should be made using appropriate elements and applicable tools from the overall process.

Evaluation Criteria

The following general criteria apply to an operator's overall risk-informed resource allocation process (These general criteria are typically reflected in the specific criteria for each process element below).

1. An operator must develop, document, implement and maintain a risk-informed resource allocation process for the ongoing identification, evaluation and management of asset-related risks. The process must include identification, selection, implementation and effectiveness monitoring of risk control measures (RCMs) throughout the life cycle of the pipeline system.
2. Executive management must be involved to ensure that the risk-informed resource allocation process seeks out and considers safety risks, and that resource decisions adequately address recognized safety risks.
3. The results from application of an operator's risk-informed resource allocation process must provide support for the safety-related proposals in its periodic General Rate Case (GRC) filings.
4. The risk-informed resource allocation process documentation must include a description of the procedure for making decisions on selection of RCMs proposed in the GRC, including enumerating responsibilities for implementing this procedure.
5. The risk-informed resource allocation process must include means by which an operator monitors the overall effectiveness of its efforts to control risk and the effectiveness of individual RCMs using a documented set of leading and lagging indicators that are periodically reviewed for appropriateness.
6. One critical source of information both on sources of risk and on the effectiveness of measures to control risk in pipeline systems is data on the location and underlying causes of various types of failures affecting system integrity. An operator must thoroughly evaluate, understand and make appropriate use throughout

the process of its understanding of the root causes of a spectrum of events ranging from system leaks to serious incidents.

7. Communication and consultation with both internal and external stakeholders must take place in support of the risk-informed resource allocation process.
8. An operator must subdivide its system into segments defined to include pipe or equipment having uniform characteristics affecting risk, and must verify that the data on these characteristics is complete, accurate and up-to-date.
9. When data, model or asset condition uncertainties contribute to significant uncertainty in its risk characterization, an operator must identify and implement means to reduce these uncertainties, and must evaluate the impact of these uncertainties on the RCMs proposed in its GRC.
10. All individuals performing activities in support of the risk-informed resource allocation process must have the knowledge and experience needed to perform their function.

General Rate Case (GRC) Filing

Criteria for GRC filings are listed below for each of the ten process elements of the risk-informed resource allocation process shown in Figure 1. For each of the ten process elements, three types of criteria are provided:

- Requirements for how the process element must be implemented;
- Requirements for how the implementation of the process element must be documented, including the data and models used;
- Requirements for how the results of each process element must be documented.

1. Identify threats to pipeline integrity

- a. An operator must develop and implement a process for identifying all credible and foreseeable threats to system assets that considers overall industry experience and company-specific experience.
- b. An operator's process for identifying threats must consider unique characteristics of its system (e.g., material of construction, soils, installation practices, joining technique, age-related issues) and physical location (e.g., seismicity, slope stability, potential for erosion of ground cover, levels of third party construction activity).
- c. An operator's process for identifying threats must seek out interactive threats (i.e., combinations of threats that represent distinctive contributors to risk); analysis to determine the root cause of leaks and incidents must be used in this search for interactive threats.
- d. An operator must determine and document the relative contribution of each identified threat to its leak and incident experience.
- e. People with system and threat-specific knowledge and experience must be actively involved in identifying threats and reviewing the completeness of identified threats
- f. Threat identification must not be a one-time step, but must be a continuing process that considers:
 - i. On-going operating experience (e.g., event reports, close calls, root cause analysis) of an operator and of the industry as a whole;
 - ii. Changes in other factors affecting risk (e.g., weather-related, geologic factors, asset aging).
- g. Specific applicable threats must be identified for each identified segment.
- h. An operator's documentation of its process must include:
 - i. Industry and operator-specific sources used in threat identification;
 - ii. Role of system and subject matter experts in threat identification;
 - iii. Methods and models used to identify and characterize system and location-specific threats.
- i. An operator's documentation of its results must include:
 - i. Threats identified from industry experience;
 - ii. Threats identified by consideration of the unique characteristics of an operator's system and its physical location;
 - iii. Interactive threats;
 - iv. The relative contribution of each identified threat to its leak and incident experience.

2. Characterize the sources of risk

- a. An operator's risk characterization methodology must use available data and results from root cause analysis to enhance its understanding of the factors that alone or in combination affect the likelihood and consequences of potential accidents.
- b. An operator must characterize and understand risk using quantitative methodologies where possible, in addition to qualitative methods, or a combination these methodologies.
- c. When its understanding of threats, risks and the effectiveness of candidate risk control measures can be enhanced by the use of quantitative analysis of event likelihood and/or consequences, and when supporting data are available, then an operator must use appropriate quantitative methodologies.
- d. In its risk characterization approach an operator must assemble and integrate data on factors affecting both event probability and potential event consequences at the segment level.
- e. An operator must validate its risk characterization methodology in light of incident, leak, and failure history information. Validation must ensure the risk assessment methods produce a risk characterization that is consistent with an operator's and industry experience, including evaluations of the factors causing or contributing to past incidents, as determined by root cause analysis or equivalent means.
- f. An operator's risk characterization methodology must be capable of informing decisions affecting implementation of new or expanded use of RCMs. The methodology must support:
 - i. Evaluating the anticipated effectiveness of candidate RCMs in reducing risk;
 - ii. Determining segment-specific and threat-specific survey or assessment frequency;
 - iii. Ranking segments for application of RCMs
- g. An operator's risk characterization approach must be designed to:
 - i. Identify risk contributors that are not readily apparent from operating history;
 - ii. Lead to better understanding of the nature of the threat; the failure mechanisms; the effectiveness of currently utilized RCMs; and means to prevent, mitigate, or reduce associated risks;
 - iii. Evaluate the likelihood of failure associated with each individual threat or risk factor, and each unique combination of threats or risk factors that interact at a common location;
 - iv. Identify and evaluate the contribution to risk from scenarios with the potential to produce exceptionally high consequences, even beyond those experienced to date.
- h. An operator must characterize the level of uncertainty associated with factors affecting event probability and potential consequences, including uncertainties associated with missing or suspect data.

- i. An operator must characterize risk using processes that are sufficiently well documented to assure consistent results independent of the qualified individuals doing the characterization.
- j. When the subjective judgments of individuals are used in the risk characterization, an operator must provide training or independent validation to compensate for possible bias.
- k. In quantitative risk characterization, techniques to estimate probability must include one or more of the following:
 - i. Use of relevant historical data;
 - ii. Logic modeling such as fault tree analysis and event tree analysis;
 - iii. A systematic and structured process for eliciting expert judgment to estimate probabilities of factors contributing to events.
- l. Results from any risk characterization methodology must be documented and presented in a manner that is meaningful to decision makers and operating staff.
- m. People with system and threat-specific knowledge and experience must review the results of risk characterization in their areas of experience for completeness and quality.
- n. An operator's documentation of its process must include:
 - i. Description of both qualitative and quantitative models used to characterize risk (both the likelihood and the consequences of events) including how these models are used to support decisions on:
 1. Which threats require mitigation,
 2. Selection of RCMs,
 3. The locations of RCMs (including pipe segments to be replaced), and
 4. The anticipated impact of RCMs on risk;
 - ii. Sources of data used to support the methods and models, including how these data have been validated;
 - iii. The level of uncertainty associated with these data;
 - iv. Role of system and subject matter experts in characterizing risk.
- o. An operator's documentation of its results must include threat-by-threat and segment-by-segment risk and the characteristics (or factors) contributing to that risk.

3. Identify candidate risk control measures (RCMs)

- a. An operator's models and processes used in identifying candidate RCMs must:
 - i. Identify candidate RCMs for each identified risk;
 - ii. Characterize the effectiveness of its existing RCMs;

- iii. Assemble and evaluate available information on industry best practices and their effectiveness in addressing identified risks by using benchmarking conducted in-house or through a 3rd-party contractor, or by demonstrating the applicability of industry-wide benchmarking studies;
 - iv. Identify and consider innovative practices or technologies for controlling identified risks;
 - v. Identify RCMs to address new external mandates (e.g., new regulations, findings of oversight agencies);
 - vi. Identify RCMs to address existing deficiencies in management and IT systems and data needed to support their use;
 - vii. Evaluate the anticipated effectiveness of RCMs based on actual experience, testing, or analysis.
- b. An operator's process for identifying candidate risk control measures must include specialized expert input on measures to control risks for which limited industry experience exists (e.g., seismic, ground movement, water flow exposing pipeline). If the needed expertise is not available in-house, an operator must use outside experts.
 - c. Candidate RCMs must address the risks to be controlled and may be either measures identified through industry benchmarking or measures an operator currently uses.
 - d. An operator's documentation of its process must include:
 - i. Description of the sources included in identifying RCMs;
 - ii. Description of the breadth of application of identified RCMs, whether broadly used throughout the industry, or employed by operators in the top quartile of performance, or innovative measures currently undergoing effectiveness evaluation.
 - e. An operator's documentation of its results must include:
 - i. Description of the candidate RCMs identified and the threats they are designed to control;
 - ii. Description of the basis for determining that candidate RCMs will be effective in controlling risk.

4. Evaluate the anticipated risk reduction for identified RCMs

- a. An operator must describe the specific ways that the candidate RCMs are expected to reduce the likelihood or consequences of identified risks.
- b. For each identified risk, an operator must evaluate the demonstrated or anticipated effectiveness of candidate RCMs in reducing the risk and characterize the uncertainty in the anticipated effectiveness of candidate RCMs.

- c. An operator's documentation of its process must include:
 - i. The basis for key decisions, including: decisions on which threats or consequences must be better controlled, decisions on which RCMs should be used, and decisions on exactly where in its system an operator should apply a particular RCMs (e.g., which parameters will be remotely monitored, which pipe segments or components will be replaced, which segments will be surveyed for leaks more frequently);
 - ii. Description of available information on the effectiveness of candidate RCMs, both in an operator's system and across the industry;
 - iii. Approach to considering uncertainty in assessing the effectiveness of selected RCMs.
- d. An operator's documentation of its results must include its evaluation of the anticipated risk reduction associated with each identified RCM, and the associated uncertainty.

5. Determine resource requirements for identified RCMs

- a. An operator must determine resource requirements for each identified RCM:
 - i. Cost estimates must reflect historic experience with the cost of implementing and maintaining candidate RCMs;
 - ii. For RCMs that are an expansion of an operator's current operation or maintenance program (e.g., more frequent leak surveys, more rapid response to leak reports), cost estimates must include determination of "unit resource requirement" based both on historic experience and on consideration, including survey of available industry experience, of how best to reduce the cost of RCM implementation.
- b. An operator's documentation of its process must include the basis for determining resources required to implement selected RCMs.
- c. An operator's documentation of its results must include the resources to implement and maintain individual selected RCMs.

6. Select RCMs considering resource requirements and anticipated risk reduction

- a. An operator must ensure decisions regarding which risk control measures (RCMs) to implement are guided by the following principles:
 - i. Selection of RCMs must consider current information on industry best practices, their application, and their effectiveness;
 - ii. Selection of RCMs must consider both identified risks and costs of applicable control measures.

- b. An operator must base its justification of the need for an RCM either on a quantitative comparison to a pre-defined acceptable risk threshold or on movement toward a desired end state such as performance in the top quartile of the industry achieved by appropriate adoption of industry best practices.
- c. If an operator justifies the need for a RCM based on movement toward a desired end state by adoption of best industry practices, it must:
 - i. Demonstrate a comprehensive knowledge of those practices applicable to the threats affecting its system;
 - ii. Evaluate the effectiveness of the practices selected for implementation;
 - iii. Continuously monitor and contribute to the evolution of industry best practices, including providing evidence of the effectiveness (e.g., through trade associations) of RCMs it has implemented.
- d. An operator must evaluate the impact of uncertainties associated with the data and the methods and models used to characterize risk on the decisions affecting the need for and selection of RCMs.
- e. An operator's documentation of its process must include the basis for selecting RCMs.
- f. An operator's documentation of its results must include:
 - i. RCMs selected and the basis for their selection;
 - ii. Major uncertainties and how they are being addressed.

7. Determine total resource requirements for selected RCMs

- a. In deciding the appropriate level of resources to expend to address known risks, an operator must determine the cumulative cost of all selected RCMs.
- b. An operator's documentation of its process must include a description of the process for determining the total resource requirements for selected RCMs.
- c. An operator's documentation of its results must include the resources required to implement each of the selected sets of RCMs.

8. Adjust the set of RCMs to be presented in the GRC considering resource constraints

- a. In determining the appropriate level of resources to expend to implement selected RCMs, an operator must identify and apply known constraints on its ability to implement changes related to each RCM, including:
 - i. The trained personnel available to carry out the work and the ability to increase and retain these personnel;

- ii. The ability to manage and control system and operational changes with existing and anticipated personnel;
 - iii. The necessary implementation sequence and time required to implement selected RCMs.
- b. An operator's documentation must include a description of the process used to determine and apply resource constraints to adjust the extent of implementation of the set of selected RCMs.
- c. An operator must develop and document a risk management plan that defines projects, schedules, and required resources. The risk management plan should include a priority list of RCMs that allows the CPUC to ascertain which measures will not be implemented if the requested level of funding is not allowed.

9. Adjust RCMs for implementation following PUC decision on allowed resource

- a. In developing its implementation plan, an operator must maximize the impact of available resources on known and anticipated risks within the constraints imposed by the CPUC rate case decision
- b. An operator's documentation of its process must include a description of how adjustments to its implementation plan are made.
- c. An operator must document the resulting implementation plan and anticipated schedule in a form that supports monitoring by the CPUC, including description of the basis for ongoing decisions on adjustments to or refinement of the plan.

10. Monitor the effectiveness of risk control measures

- a. An operator must identify metrics for use in monitoring the effectiveness of individual RCMs as well as of the aggregate set of existing, new, and modified RCMs.
- b. An operator's monitoring and improvement processes must ensure that RCMs are effective in achieving the anticipated risk reduction.
- c. An operator's monitoring and improvement processes must include a description of how the overall risk-informed resource management process is modified to reflect implementation lessons.
- d. An operator must establish a process to evaluate and report upon its compliance with commitments made in each General Rate Case.
- e. An operator's documentation of its process must include a description of the means to be used to monitor the effectiveness of selected RCMs as well as the aggregate impact of RCMs on overall risk.
- f. An operator's documentation of its results must include:
 - i. The indicators and/or metrics selected to monitor future trends in RCM performance and contribution of each RCM to risk reduction;

ii. The baseline value for selected indicators and/or metrics and how it was established.