BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

COMBINED UTILITIES PRELIMINARY COMMENTS TO SAFETY and ENFORCEMENT DIVISION (SED) STAFF AS LOW AS REASONABLY PRACTICABLE (ALARP) WHITE PAPER

SAN DIEGO GAS & ELECTRIC COMPANY
SOUTHERN CALIFORNIA GAS COMPANY
SOUTHERN CALIFORNIA EDISON COMPANY
PACIFIC GAS AND ELECTRIC COMPANY

December 1, 2015

Overview

In response to the email and attachment sent by Steven Haine of the California Public Utilities Commission's Safety and Enforcement Division "*Subject: A.15-05-002, et al. - Preliminary SED Staff Whitepaper on ALARP for use in SMAP workshop #4,*" this document represents combined comments of San Diego Gas & Electric Company, Southern California Gas Company, Southern California Edison Company, and Pacific Gas and Electric Company (hereafter, the Utilities or combined utilities). The comments include an overview section, a summary of highlights and a detailed technical review of each section of the ALARP white paper.

The combined utilities appreciate the SED's efforts in publishing the white paper *As Low As Reasonably Practicable (ALARP) Risk-informed Decision Framework Applied to Public Utility Safety* (hereafter, "white paper"). The white paper identifies areas for discussion that may be applicable in future S-MAP and regulatory proceedings.

The Utilities agree with the objectives of the ALARP white paper to evolve rate proceedings and to progress toward decision making processes to balance rates with an acceptable risk level. However, there are concerns and key issues that are difficult and will take substantial effort to discuss and ultimately resolve before use of ALARP or similar methods. Among these are the following:

1. Utilities cannot themselves establish an acceptable risk tolerance level for ratemaking purposes; regulators must be involved.
2. Risk management calculations included in rate proceedings need to be readily communicated and understood by all parties.
3. A value to measure the risk tolerance level against should be acceptable to all stakeholders; The Value of Statistical Life used in the ALARP white paper is not appropriate for this purpose.
4. Adoption of new risk tolerance calculations will not be quick. The timeline for implementation of any risk tolerance method needs to be realistic and align with the abilities of all stakeholders.

The white paper states at p. 3: "An ALARP framework would allow a utility operator to lessen the reliance on subjective and qualitative judgment by methodically determining how much risk mitigation is needed in a way that balances safety with cost." However, this statement assumes that the data and other elements required to eliminate subjective inputs and complete an ALARP

framework are readily available (they are not) and that the process for establishing the tolerance boundaries is already set (which is not the case). While the combined utilities welcome the discussion of ALARP and related concepts, it is far from clear that ALARP would allow less reliance on qualitative judgment, because ALARP methodologies have not been reviewed, tested, or implemented into the California regulatory rate process.

The Commission, utilities and intervenors need time to evolve the regulatory and risk management processes. The utilities will continue to work with the CPUC to discuss and explain jointly established methods and processes for risk management that they are currently employing and evolving. The CPUC needs to engage in parallel efforts to understand and apply the current utility risk management processes in the rate proceedings, as well as look for ways that concepts similar to ALARP can be included.

Summary of Review

The *As Low As Reasonably Practicable (ALARP) Risk-informed Decision Framework Applied to Public Utility Safety* white paper presents a discussion concerning the balance of societal concerns with risk exposure to utility operations.[1] The ALARP concept as outlined in the white paper and referenced documents provides an opportunity for the utilities, intervenors and regulators to better define the regulatory and utility operational risk management process. The combined utility companies agree in principle that there is:

- a level of exposure to risk that is intolerable; irrespective of cost;
- a region where further benefit/cost makes sense; and
- a region of acceptable risk.

That being said, the devil is in the details. All parties need to be using the same constructs for tolerance, costs, benefits, "acceptability" and what method is to be used to determine appropriate risk mitigation. The combined utilities provide this document for consideration and discussion to continue the evolution. The concepts in the white paper are thought-provoking but need a great deal of discussion if they are to move beyond the conceptual level to evolve into useful

[1] The author also provides links to several references from which the contents are drawn.

processes. A substantial amount of work is necessary; expectations and responsibilities need to be discussed and resolved.

The following summarized areas are discussed in further detail in the subsequent section:

- Population risk versus individual risk needs to be discussed and clearly understood. In the example of acceptable tolerance discussed in the white paper, it is not clear if the levels of tolerance presented have the probability and impact applied to an individual fatality or the fatality of an individual in an aggregate exposed population. The white paper may lead to some confusion in the application and expectation of risk tolerance for an individual versus a population.

- The ALARP region, combined with the FN curve establishes a Risk Tolerance curve. Anything above is unacceptable. Anything below is considered tolerable. A distinction of what is broadly acceptable becomes moot at that point when considering mitigation activities.

- It must be determined who sets the tolerance levels and who determines the gross disproportionality factor if ALARP is to be used for risk management in ratemaking. The white paper appears to assume that utilities will set tolerance levels and the regulatory body will set the gross disproportionality factor (although this is not wholly clear) and neither choice seems obviously correct.

- Risks are additive. That is, ten individual risks managed below an acceptable tolerance level of fatalities may violate the tolerance at the cumulative sense. The white paper discussion stating that multiple risks would be evaluated against the same tolerability limits overlooks the additive nature of risks. Mitigating multiple risks below a certain tolerance level does not mean that the additive risk exposure of the multiple risks does not exceed the tolerance level.

- All options for defining risk tolerance should be considered. For example, the risk management concept of Loss Exceedance analysis can provide a viable alternative to ALARP, with additional benefits such as scalability. However, either concept will take time to evolve capabilities and processes.

- There is uncertainty and a lack of understanding of the ALARP concept (and how it might be applied) for regulatory decision making due to a lack of current technical skill sets, processes, and knowledge base of all parties. At this time even the ability to accurately communicate these concepts is uncertain.

- The evolution and implementation of concepts like ALARP must be realistic. Caution is appropriate when adopting an ALARP type framework, as noted in an Australian document referenced in the white paper:

> *Risk uncertainty - it is expected that risk related decision making should be made with sufficient certainty and understanding of the both the likelihood and consequence of an event occurring. Where this is not the case a precautionary approach to demonstrate risks are ALARP should be taken.*[2]

Detailed Comments to ALARP White Paper

The *As Low As Reasonably Practicable (ALARP) Risk-informed Decision Framework Applied to Public Utility Safety* white paper presents a discussion concerning the balance of societal concerns with risk exposure to utility operations. The following comments will hopefully facilitate discussions at the upcoming S-MAP workshop.

Introduction

As noted above, the Commission has to determine for itself whether "an ALARP framework would allow a utility operator to lessen the reliance on subjective and qualitative judgment by methodically determining how much risk mitigation is needed in a way that balances safety with cost." The data and other elements required to eliminate subjective inputs and complete an ALARP framework are not readily available and that the process for establishing the tolerance boundaries have not been set.

History of the ALARP Principle

In the History of the ALARP Principle section, the white paper discusses radiation exposure and ALARA. The ALARA exposure limits addressed are actually more conservative than the maximum tolerance levels established. The implications are that the utilities will be able to adopt more conservative risk mitigation activities than a cooperatively or regulatory established tolerance level. This discussion is expounded in Appendix 1.

[2] Australian National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) Guidance Note on ALARP: http://www.nopsema.gov.au/assets/Guidance-notes/N-04300-GN0166-ALARP.pdf

How Does ALARP Work?

ALARP is conceptually explained in the white paper, but some of the details are complex and perhaps could be more thoroughly addressed. For example, the white paper seems to conflate individual risk tolerances and population risk tolerances.

The white paper states at p.9: The threshold accident rates of 10^{-4} deaths/year (for members of the public) or 10^{-3} deaths/year (for employees of the utility company) are numbers cited in the UK's Health and Safety Executive (HSE) Guidance on ALARP Decisions in the HSE's Control of Major Accident Hazard (COMAH) regulations document *Reducing risks, protecting people, HSE's decision-making process.*[3]

Comment: Both the text in the ALARP white paper and the HSE paper may lead to some confusion in the application and expectation of risk tolerance for an individual versus a population. The example provided only discusses the 10^{-3} deaths/year and 10^{-4} deaths/year. We submit the expanded example below for discussion and understanding. The example text should read:

> The threshold accident rates of 10^{-4} deaths/PUBLIC YEARS (for members of the public) or 10^{-3} deaths/EMPLOYEES YEARS. A tolerance level for a utility company of 10^{-3} deaths/year can be interpreted as 1 individual death every 1,000 years. In actuality that is the probability associated with an individual meeting a fatal incident in that year. The added text clarifies that the tolerance level should be applied to the population. To further expound the example, consider that PG&E has approximately 24,000 employees. The absolute tolerance level for 10^{-3} deaths/EMPLOYEES YEARS would be 24,000 employees * 10^{-3} deaths/employees years or 24 deaths per year. Even if we were to consider that only 50% of the workforce may be exposed to the hazards associated with utility work, the tolerance level would be 12 deaths per year. PG&E has averaged less than 1 fatality per year over the past 20 years, as provided in the example of the SED report on the Gas Transmission and Storage rate submission[4]. This suggests that the

[3] HSE Guidance on ALARP Decisions in COMAH, Tolerability Limits, p. 49, http://www.hse.gov.uk/foi/internalops/hid_circs/permissioning/spc_perm_37

[4] California Public Utilities Commission Safety and Enforcement Division Final Staff Report, Pacific Gas & Electric Company Proposal for Cost of Service and Rates for Gas Transmission and Storage for 2015-2017 Application 13-12-012, September 11, 2014, p. 51.

current risk management activities are reasonably practicable and not grossly disproportional, even though they are well below an applied example tolerance levels provided in the white paper.

In short, risk tolerances for individuals, and risk tolerances for populations must not be confused.

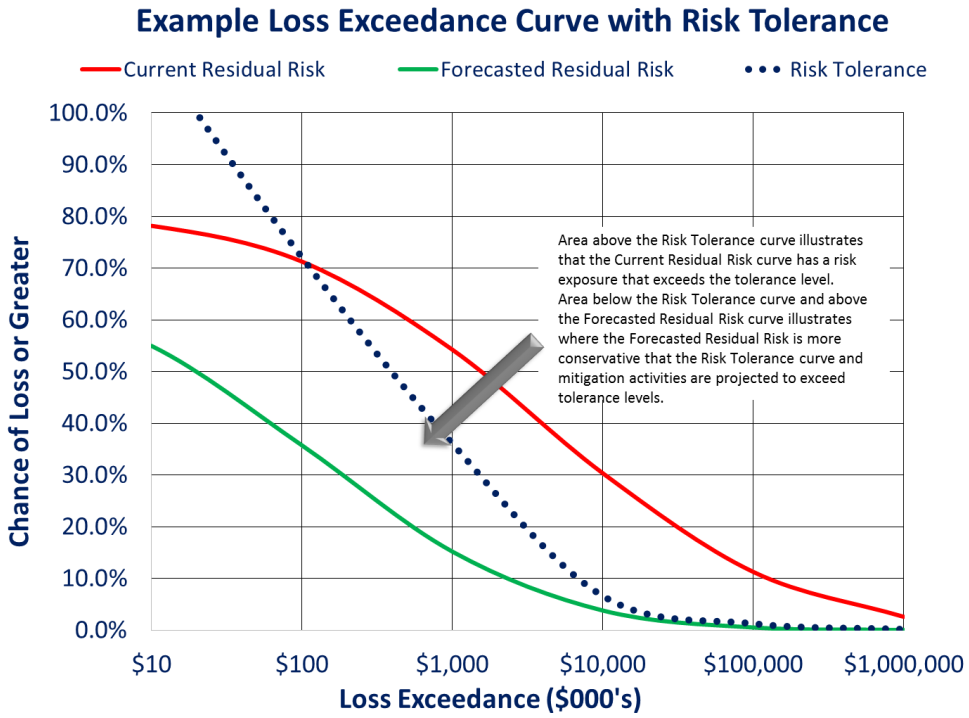
The white paper also addresses the relationship between the ALARP region, FN curves, and risk tolerances. Again the combined utilities believe there needs to be some additional discussion of these concepts.

The white paper states at p.15: "Risk mitigation must be applied until the FN curve falls just below the upper tolerability limit line as shown in Figure 6."

The white paper here appears to be describing an iterative process. However, the FN curves establish a risk tolerance level. Once this is established it makes the intolerable, ALARP, and broadly acceptable regions moot. After the FN curve establishes the acceptable tolerance, risk mitigation activities and controls that do not violate the tolerance level can be evaluated.

A method for probabilistic risk analysis using a loss exceedance curve supports the objectives discussed in facilitating an acceptable level of loss (risk) within a set probability. Figure 1 below illustrates what a loss exceedance curve in theory would look like. Additionally, the method employed to develop a loss exceedance curve is scalable to a portfolio of risk. Loss exceedance curves should be evaluated for use in ratemaking.

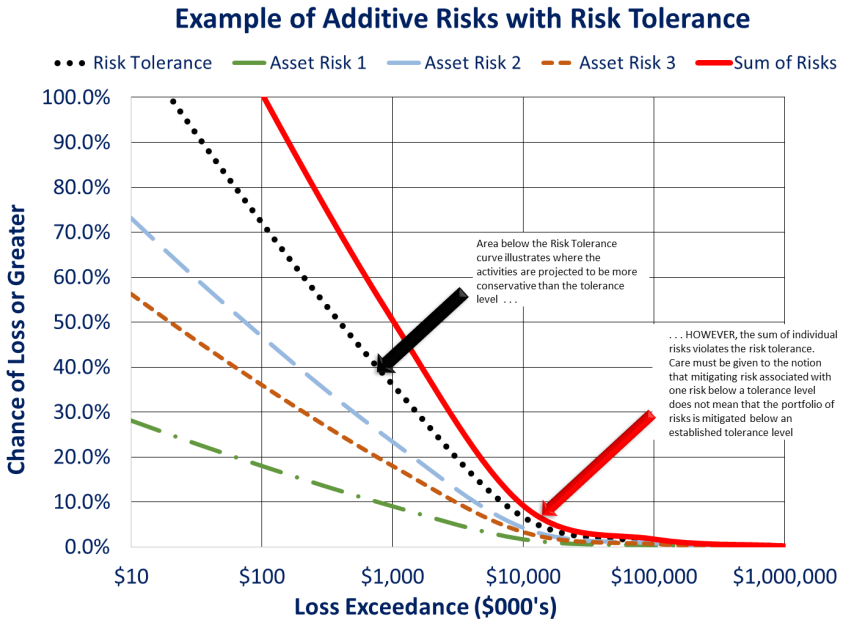
Figure 1 - Example Loss Exceedance



The white paper states at p.22: Under ALARP, both external corrosion and internal corrosion would be subject to the same tolerability limit lines and the same disproportionality ratio. However, the respective methods used to mitigate the two different risks will have different costs and different levels of risk reduction benefit relative to cost. A separate cost/benefit ratio would be calculated for external corrosion and internal corrosion.

Comment: The concept of cost/benefit ratio can be evaluated in the loss exceedance analysis. The discussion that both risks would be evaluated against the same tolerability limits overlooks the fact that risks are additive. Accordingly, simply mitigating multiple risks below a certain tolerance level does not mean that the additive risk exposure of the multiple risks does not exceed the tolerance level. Figure 2 graphically illustrates three separate asset risks being mitigated below a tolerance threshold. The cumulative nature of the risk exposure violates the tolerance level. As all parties consider ALARP and other potential methods for evaluating and communicating risk mitigation investments per dollar, the additive nature of risks should not be overlooked.

Figure 2 - Example of the Sum of Risks and Tolerance



ALARP Criterion of Gross Disproportionality

The white paper states at p.22: Conceptually, gross disproportionality exists when the cost of risk mitigation greatly exceeds the benefit derived from the mitigation activity.

Comment: The concept of "grossly disproportional" is presented with the recommendation that the "ratio should be set by a regulatory body" and does not discuss the process for establishing that ratio or defining the ratio. Is the ratio purely a financial ratio or the cost divided by some other metric or unitless value? Additionally, on page 25, the range of a 2 to 10 times the costs to the returned benefit is provided as an example of "grossly disproportional" but stops short of recommending what the range should be. These issues must be discussed and resolved before any framework is implemented.

How Does ALARP Differ from Traditional Cost/Benefit Analysis?

The white paper states at p.26: "Traditional cost/benefit analysis (CBA) relies on a simple go/no-go criterion of whether the cost exceeds the benefit, i.e., if C/B>1, then stop."

Comment: This is not necessarily correct. While most decisions using CBA do apply a binary selection, there are ways to modify the binary selection to evaluate options along a spectrum of CBA. For example, programs designed to improve reliability are often evaluated in "tiers" or "groups" of potential investments. They are then evaluated as a set of alternatives against other potential investments.

For example, consider a set of 5 tiered alternatives and a constraint is applied in portfolio analysis that at least one of the tiers in a group of alternatives must be selected. In essence the binary CBA is not applied because the decision criterion considers more than one option. In the cumulative portfolio analysis, the portfolio is optimized with the greatest possible cumulative CBA.

The discussion of loss exceedance using simulation modeling also facilitates the objective and solution that the ALARP framework seeks to achieve of probabilistic portfolio analysis and selection within risk mitigation options.

Application of frameworks such as ALARP need to balance complexity versus simplicity, the skills sets and acumen of the parties using and communicating the framework, and the timeline to implement and achieve the expected results of the framework.

The combined utilities welcome the continued discussion and evolution of risk management in support of the rate case proceedings. However, we want to make sure that any decisions on framework and methodologies make sense for all parties, and, in the interim, continue to work with the current state of the risk management frameworks being applied and communicated.

Value of a Statistical Life

The white paper states at p.22: Since costs are in monetary terms, this process in effect also requires the translation of predicted benefits (reductions in loss of life, reductions in injuries, and reductions in property damage, etc.) into monetary terms.

Comment: The premise of this section of the white paper is that the risk evaluation needs to be tied to the Value of Statistical Life (VSL). However, risks being considered in ratemaking for utilities are many forms of potential negative losses. The loss may be a life or an injury or it may

be utility infrastructure or third party assets. All have economic implications or values. Furthermore, actuarial tables have been established for just about any potential loss of life, limb, or property. The combined utilities are opposed to using VSL as the metric for evaluating risk mitigation.

If the CPUC is looking to establish monetary values to evaluate risk mitigation against as a standard, then the combined utilities recommend that it establish standard monetary values associated with specific items to mitigate against and publish these standards through a formal process that results in adopted values.

How does an ALARP Framework Relate to Risk Tolerance in Enterprise Risk Management?

The white paper states at p.31: There are three relevant perspectives to risk tolerance: societal perspective, regulatory perspective, and utility operator (corporate) perspective. Risk tolerance from utility employees' perspective is subsumed in the societal category.

Comment: Risk tolerance has many varying perspectives. Society at large has many risk takers and many who are risk averse. Trying to categorize risk tolerance in this way presents many issues. Discussions at workshops should address these perspectives. In keeping with the opening point in the paper, which was exploring "ALARP and its possible application to the safety aspects of public utility operations and rate cases," these perspectives might be better considered in alignment to the traditional participants in the ratemaking process: utility; consumer advocates; and regulators. Employees could be subsumed as part of the utility and consumer advocates, as they are represented in by both stakeholders who will represent the constituency positions.

The white paper states at p.32: Under ERM, risk tolerance can be defined as the maximum amount of residual risk that an organization is willing to accept after application of risk control measures.

Comment: Utilities should not themselves be wholly responsible for establishing the risk tolerance level applicable to ratemaking. Rather, the utilities within the regulatory process and with the guidance of CPUC should jointly establish the tolerance level that utilities, intervenors

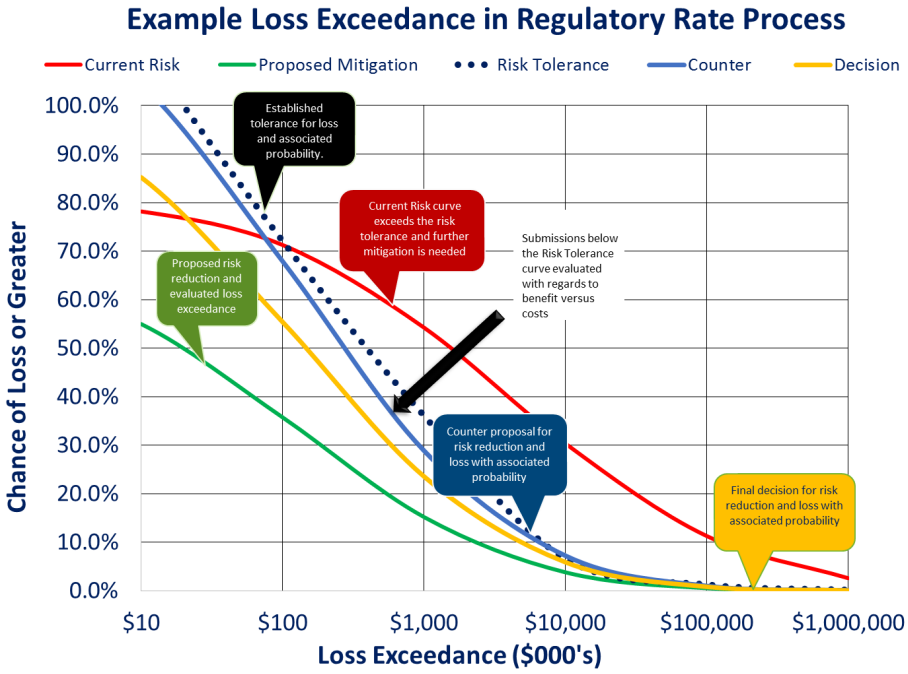
and regulators will operate within. It will then be the function of the ERM and the utility to demonstrate its evaluation and risk mitigation controls that are meet or exceed the established tolerance.

In rate proceedings, utilities will present additional risk mitigation activities and resource requirements and justify them on the appropriate basis, including risk reduction or other defined metric.

The process itself should result in four steps: i) risk tolerance established; ii) submitted mitigation and resource requirements with impacts on rates; iii) counter proposal and risk exposure analysis; and iv) final decision.

Figure 3 illustrates how this would look using a loss exceedance methodology.

Figure 3 - Example Loss Exceedance Use in Regulatory Rate Process



An ALARP Framework Among Competing Objectives and Constraints

The white paper states at p.35: Without an ALARP framework, decisions on what mixture of mitigation measures to use or how quickly to apply those selected mitigation measures are made through subjective judgment informed by best practices, compliance requirements, availability of resources, etc.

Comment: This statement is not necessarily true. Simulation modeling and analysis not in an ALARP framework could be implemented. Additionally, fault or decision tree methods could achieve similar objectives. The Commission cannot adopt ALARP or any other framework without understanding what the desired elements of any framework are. Desirable attributes include adequately accounting for uncertainty, recognition of probability versus impact, reducing subjectivity, and establishing a framework and methodology that is easily communicated and understood in a regulatory environment when considering rates and funding risk management activities.

Best Practices in an ALARP Framework

The white paper states at p.38: Furthermore, if an ALARP framework was formally adopted by a regulatory body, the regulated utility would have sufficient legal justification to deviate from industry best practices when an ALARP framework indicates it to be reasonable to do so.

Comment: Regulatory requirements are mandates, even if ALARP produces a riskier result. This assumes that the Commission allows recovery for all mandated programs. That being said, if the ALARP or Loss Exceedance analysis determines a better but more costly solution to reduce risk, the process needs to determine if that is affordable or that the risk is acceptable. The comments here presume that the 10-month frequency for leak surveys will be performed, but does not address the associated funding requirements or the risk trade-offs that will have to be evaluated.

Hurdles to Acceptance of an ALARP Framework

The white paper states at p.39: A cultural change would need to take place to inculcate the idea that risk never be driven down to zero with any affordable safety budget in the real world and

that society must be willing to accept an explicit residual risk as a tradeoff between safety and utility rate affordability.

Comment: In general, the Utilities agree with this section of the white paper. However, the regulatory process for the past decades has implicitly resulted in a tolerance level. It is incorrect to imply that risks have not been managed by the process and the utilities. What we are evolving to is a more mature and codified method for presenting, evaluating and communicating risk management in the rate case process to ensure that cost alternatives are balanced explicitly with risk exposures. This does not necessitate a cultural change per se, but an evolution and a public recognition, confirmation, and discussion that risks can be addressed and mitigated, but never eliminated.

Conclusion: Why Adopt an ALARP Framework in Rate Cases?

The white paper states at p.42: Adoption of an ALARP framework would overcome utility operators' reluctance to state an explicit risk tolerance in their enterprise risk management. A regulatory body's promulgated upper and lower tolerability limits in ALARP would act as the equivalent risk tolerance limits in enterprise risk management.

Comment: The risk discussion and requirements that have evolved over the past couple of years have demonstrated the complexities surrounding the topic and potential misunderstanding of risk management (e.g., vision zero) by all parties responsible for implementing that change. The regulatory evolution places the utility in a difficult position with regards to expectations and potential implementation of concepts that are still being debated. ALARP will not change this, unless the parties understand that risk tolerance levels and methodologies for implementing the risk evaluation and communication must be established in a cooperative way.

Recommendations and Roadmap and Required Elements of ALARP Implementations

The white paper states at p.43: Regulators and stakeholders in utility rate cases should start the discussion now to consider implementing ALARP into rate cases.

Comment: The Utilities urge the Commission to consider not only ALARP, but concepts other than ALARP as well. The basic characteristics that the CPUC is looking to include in rate case proceedings include i) accounting for uncertainty, ii) probability versus impact, iii) reducing

subjectivity; and iv) establishing a framework and methodology that is easily communicated and understood in a regulatory rate case environment. There are other alternatives that should be discussed in order to achieve these goals. While the Utilities believe that any framework is still years away from implementation, we continue to support the initiatives to evolve the regulatory rate case process.

Conclusion

These jointly submitted comments with regard to the white paper on ALARP provide a basis to focus discussion and review of ALARP and other applicable methodologies for evolving the rate case process to include risk management. The Utilities again applaud the CPUC SED efforts in proposing a framework that will initiate discussion and welcome the opportunity to continue the maturing of this effort.

Appendix 1 – Comment on History of the ALARP Principle

The white paper states at p. 6: "The U.S. Nuclear Regulatory Commission has used a principle similar to ALARP since the 1950s to regulate exposures to radiation (where it goes by the name As Low As Reasonably Achievable, ALARA). In 1972 and in 1977 the ALARA principle was adopted into two U.S. federal regulations (10CFR835 and 10CFR20) to regulate radiation exposures at Department of Energy and NRC-regulated facilities."

Comment: The ALARA exposure limits addressed are actually more conservative than what the maximum tolerance levels are depicted in the ALARA table.

Figure 4 – Maximum Regulated Levels of Radiation Exposure[5]

Maximum Annual Occupational Dose Limits

Whole Body ..... 5000 millirem
Extremities ..... 50000 millirem
Lens of the Eye ..... 15000 millirem
Fetus ..... 500 millirem*
Individuals in the General Public ...100 millirem
* 500 millirem for the fetus is during the *gestation period*

As noted in the NC State University Radiation Safety forms, "the ALARA concept imposes lower operational dose limits that are even more restrictive than the maximum legal dose limits in the table above. This ensures an enhanced safety factor for what are already considered to be safe annual doses for radiation workers"[6] In reviewing the ALARA and subsequent references, the regulatory and governmental bodies established the maximum level of tolerance. Organizations that operated within a radiation environment had the flexibility to perform activities well below the tolerance levels and establish alert points as ALARA that would initiate review of processes and risk management controls and mitigation activities, if violated.

This makes sense, but given the current level of discussions in S-MAP, it appears that ALARP in the context of the utility rate making is being considered as an investment and risk mitigation ceiling. If the focus of ALARP is to move risk mitigation activities and controls to a level that reduces risks to a tolerable level, then the utilities are in support of that ideal. At issue is defining the tolerable levels.

[5] NC State University – Environmental Health and Safety; Radiation Safety and ALARA, p.2 https://www.ncsu.edu/ehs/radiation/forms/alara.pdf

[6] NC State University – Environmental Health and Safety; Radiation Safety and ALARA, p.2 https://www.ncsu.edu/ehs/radiation/forms/alara.pdf