APPLICATION OF RISK-BASED VALUE-IMPACT ANALYSIS IN A NUCLEAR REGULATORY ENVIRONMENT

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INTRODUCTION

Value-impact analysis is a quantitative process that examines the benefits of proposed actions and the costs of implementing those actions to determine the potential for a net beneficial result. In Canada and the United States, value-impact analysis (VIA) has been used or proposed to support decision-making within the commercial nuclear power industry.

The motivations for using VIA differ, according to the particular sector of the industry applying its techniques. Regulators may tend to use VIA in order to assess the benefits to society of proposed regulatory actions, most often at a generic level. In this context, VIA is typically used to identify the most effective or least intrusive of a number of alternative actions proposed for achieving the same end. The need for action is not usually identified through the use of VIA; rather, requirements for regulatory intervention are generally established by other means [**1,2**]. Utilities, on the other hand, tend to apply VIA in a more traditional way, seeking the best balance between costs of various actions and their projected effects on safety and economic performance. Among the proposed actions that utilities address are those suggested by regulators for the purpose of maintaining or enhancing nuclear power plant safety.

Given that utilities and their regulators have each considered the use of VIA as a means to better inform their decisions, it is natural that its methods would be applied to issues that they both have in common - those actions proposed for controlling risks arising from the operation of nuclear power plants. These risks are derived mainly from the potential occurrence of extremely rare events that can release large quantities of radioactive materials from the reactor core. Most often, probabilistic risk or safety assessments (PSAs) or similar quantitative evaluations are used to determine accident probabilities and consequences and to quantify the potential change in risk associated with proposed actions. VIAs that utilize the results of PSAs or similar quantitative risk analyses are called risk-based value-impact assessments, and are the subject of this paper.

VIA Applications in the US and Canada

The U.S. Nuclear Regulatory Commission (NRC) applies risk-based VIA to assist in the ordering of its own initiatives for nuclear safety regulation [**2,3,4**]. Following the Three Mile Island event, many utilities began developing integrated schedules for controlling the implementation of the many regulatory and utility initiatives proposed to improve safety. Several utilities developed VIA to support selection and ranking of the most efficacious initiatives for plant improvement.

The USNRC has proposed coordinated utility/regulatory agency application of VIA to develop integrated evaluations and implementation schedules for regulatory actions, the most notable attempt being the Integrated Safety Assessment Program (ISAP) of 1984-1987 [**5,6**]. ISAP was a pilot program, involving only a single utility and two operating nuclear plants. It demonstrated the effectiveness of VIA as an evaluation, planning, and decision-making tool in the nuclear regulatory environment. However, when the NRC later offered other reactor licensees the opportunity to participate in the program [**7**] none showed sufficient interest, and this early opportunity in the U.S. for coordinated regulatory and utility use of VIA was terminated.

No formal requirement to use VIA methodology in assessing regulatory proposals is imposed on Canadian regulators, but a more general requirement suggesting the need for VIA is contained in the Regulatory Reform Policy, Guiding Principle No. 5, which states:

> *"Regulation entails social and economic costs and the government will evaluate these costs to ensure that benefits clearly exceed costs before proceeding with new regulatory proposals."*

Unlike the USNRC, the Canadian nuclear regulatory authority (the Atomic Energy Control Board - AECB) has not utilized the results of PSA in a direct way in support of safety decision-making. As a result, innovation in this area tends to be driven by the action of the utilities. Among Canadian utilities Ontario Hydro is preparing full-scope Level 3 PSAs for each of its nuclear plants, and is actively investigating the benefits of VIA for decision-making on plant modifications [**8**]. Ontario Hydro has included VIAs in some recent safety-related submissions to begin to examine their potential usefulness in the regulatory process.

Both U.S. and Canadian utilities and the USNRC continue separately to develop and use PSA and VIA methods, and the available methods are, in many cases, certainly capable of supporting safety and economic decision-making in the broader context that includes utilities and regulators. What is more, the opportunities for coordinated regulatory/utility application of risk-based VIA in the U.S. and Canada appear to be better today than ever before, because of the increasing availability of plant-specific PSAs, including those being prepared for all U.S. nuclear plants under the Individual Plant Examination program [9].

There would now appear to be a sufficiently broad dissemination of the techniques and tools of PSA throughout the Canadian and U.S. nuclear industries to support the general application of VIA for coordinated decision-making on safety and economic issues. While independent use of VIA will obviously benefit decision-making, it is in the coordinated application of VIA for industry decision-making on common issues that these methods can potentially provide most benefit to safety and the prudence of nuclear power plant operation.

Nonetheless, a number of issues must be addressed satisfactorily before the use of VIA in a coordinated decision-making mode can be successful. Certain issues are inherent in the choice to use VIA for decision-making. Others arise from the fact that nuclear industry decision-making takes place in a multi-party, highly regulated, and politicized environment where each party to the decisions may have entirely different objectives or motivations. This paper examines some of the more important issues that might be encountered in attempts to apply VIA in a coordinated regulatory/utility decision-making mode.

ISSUES ENCOUNTERED IN THE USE OF VIA

Issues encountered in the use of risk-based VIA for decision-making may be broadly categorized as **inherent** - those associated with the methods of VIA and its underlying philosophy; or **contextual** - those associated with the need to apply VIA within the multi-party nuclear regulatory environment as it exists in Canada and the United States. Examples of each type of issue are described below, with emphasis on those that, from the authors' experiences, are most frequently encountered.

Inherent Issues

Inherent issues accompany the use of VIA regardless of the context (e.g., the regulatory environment) in which it is used. They can be further decomposed into two classes: philosophical and methodological issues.

Philosophical Issues. The safety decision-making process begins with the identification of a perceived safety deficiency followed by the proposal of one or more alternative courses of action to address the deficiency. If used, VIA attempts to identify and quantify the diverse aspects of the decision and each alternative action in a manner that clearly presents all data and assumptions, so that an informed decision can be made. This comprehensive presentation invariably generates debate over several controversial social issues. Some of these are discussed below.

Considering Safety in an Economic Context. VIA permits comparison of the benefits of proposed changes to their estimated costs, thereby providing a direct means of assessing the comparative worth of actions to improve the safety of nuclear power plant operation. Such benefit-cost comparisons require that monetary equivalents be assigned to a variety of actual and potential health effects - and this can become a source of controversy. That the principle of weighing safety issues economically remains a cause for concern in some quarters is perhaps surprising, because it is self-evident that there are practical limits on safety spending that should be controlled by cost-benefit or ALARA/ALARP considerations.

Admissibility of Quantitative Judgements. There are those who insist that judgements specifically related to public safety should not be reduced to quantification. When VIA is used to inform and justify a particular decision, it forces the user to commit on elements of the decision that otherwise might be glossed over, and facilitates the identification of important aspects of the decision that may have been omitted in a more subjective process. The increasing availability of quantitative information on the risks of nuclear power plant operation also allows direct comparison of these risks with the other risks to which society is exposed. Understanding the comparability of risks supports development of regulatory policies that effectively protect the public without requiring disproportionate expenditures of public and private resources [**10,11**].

Utilitarianism. The use of VIA also implies acceptance of a utilitarian philosophy that many consider incompatible with the proper concerns of government in an individualistic society. Unfortunately, rejection of this philosophy does not eliminate the need to make decisions affecting the health and safety of large numbers of individuals. VIA represents arguably the most objective method for informing nuclear industry decision makers, but they may or may not accept its recommendations. However, they are entitled to the information that VIA provides and certainly are obligated to acknowledge the implications if the information is not used.

Methodological Issues. The present limited use of risk-based VIA within the nuclear industry is to some extent associated with the inherent limitations of the risk analyses that support it. The uncertainty associated with statistical and phenomenological modeling of rare events and in the data used to quantify these models may make decision makers reluctant to rely upon the explicit outcomes of risk analyses as the primary basis for decision-making. Among the many methodological issues that can be raised, three that could substantially limit the usefulness of VIA in safety decision-making if poorly addressed are:

- o the definition of generic elements of value and impact for use in constructing VIA models;
- o the selection of parameters for measuring safety impacts; and
- o the valuation of safety impact parameters, especially those derived from PSAs.

Each of these issues is discussed below.

<u>Definition of Terms</u>. Surprisingly, there is no common interpretation of the terms "value" and "impact" within the community of nuclear decision makers using VIA. Definitions vary depending on the application and the individual practitioner's perception of what is important in the analysis. The lack of consistency in approach offers a potential stumbling block to the coordinated application of VIA in the nuclear industry.

<u>Selection of Value and Impact Measures</u>. There is general consensus on the economic and safety parameters that should be considered in a risk-based VIA. There is less agreement on the manner in which these measures should be combined to produce an objective and meaningful assessment of the worth of a particular course of action. The treatment of the economic consequences associated with onsite and offsite property damage offers a good example of the variety observed in both the selection and combination of value and impact measures for a VIA. Some methods omit entirely the consideration of onsite property damage, because it is not "safety related". Others use surrogate measures, as in the treatment of off-site property damage by artificially inflating the dollar value for off-site health effects.

Eliminating explicit consideration of on-site property damage in VIA reduces the potential value of any proposed safety improvement. This has the effect of making the VIA model less conservative from a safety standpoint because the averted cost of on-site damages increases the total value of any proposed safety modification that also reduces public risk. Another approach uses averted onsite cost to offset the total implementation cost of a proposed action [**12**], which makes all proposals appear more beneficial but at the expense of sometimes obtaining ludicrous outcomes such as a negative total implementation cost.

The use of an artificially high dollar value for public dose also has some inherent drawbacks. First, there is the strong negative correlation between offsite economic consequence and dose. Costs of decontamination are reduced if high intervention dose criteria are assumed, but public dose increases. Thus, if offsite economic consequence is not explicitly estimated, it is possible to minimize dose by assuming very low intervention criteria without paying the corresponding economic penalty. A second problem associated with this type of modeling is the danger that an artificially high dollar value for dose will come to be regarded as the standard for other applications.

Valuation of Impact Measures. In attempting to value (quantify) risk-analysis-derived impact measures, three distinct issues are generally encountered: defining competing risk situations properly, assuring the credibility of the risk estimates used, and assigning consistent and acceptable valuations to risk parameters, especially those related to health.

Defining Competing Risk Situations. The best basis for estimating change in risk is the result of two comparable quantifications of the whole or portions of a detailed, plant-specific PSA. The implications of a proposed safety modification can often be expressed in terms of a change in the frequency of one or more consequence categories. For many improvements, this limits the need to reanalyze and requantify the entire PSA model. Even in these cases, extracting a credible estimate of the risk changes associated with a proposed regulatory action may not be easy because most changes usually involve beneficial and detrimental effects with respect to accident frequency. A design change to an important support system may affect a number of sequences, plant damage states, and release categories, requiring substantial work to redefine and reintegrate the fault tree models so that a sufficiently accurate estimate of the expected risk change can be obtained.

In the authors' experience, the definition of competing risk situations is perhaps the most fundamentally difficult element of the application of VIA. If performed improperly, this element of the process offers the greatest potential for skewing the results of the evaluation.

Credibility of Risk Estimates. It remains to be proved that nuclear power plant PSA results used in VIA are sufficiently accurate representations of actual risk. However, extreme accuracy is unnecessary for most safety decisions supported by VIA, given the very low levels of risk that are believed to have been attained in the operation of modern nuclear plants. In those situations where VIA results suggest that risks are generally too low to justify significant expenditures on plant modifications or major component upgrades, the resources that would normally be used for these purposes could be redirected, for example, to ensure that existing equipment can reliably perform its intended safety function.

There is also the related issue of the uncertainty in PSA risk results, especially in the modeling and data characterizing the releases and consequences of severe accidents. This difficulty is ameliorated in those cases where the risk implications of plant modifications can be adequately expressed as the change in frequency of one or more broadly-defined consequence categories, which reduces the sensitivity of the VIA to some important sources of PSA uncertainty. Uncertainties are always present; VIA offers the advantage of allowing them to be explicitly displayed and acknowledged in decision-making.

Valuing Risk-Related Parameters. The assignment of suitable dollar values to the various impact parameters used in a VIA can be difficult, requiring a relatively mature understanding of fundamental economic principles such as cost levelization [**13**]. The assignment of suitable dollar equivalents to stochastic elements of value, such as averted dose, is even more difficult and requires a clear understanding as to exactly what is being quantified. The public safety benefit of a proposed modification arises directly from a reduction in the risk of release of radioactivity. In VIA this safety benefit is represented as dose or as lives saved, so an estimate of the resources society is willing to expend to "save a life" is required. Evaluation of actuarial data in areas such as highway safety and medicine indicate a very wide range of expenditure is experienced, depending upon the number of people potentially affected by the hazards being protected against. An intermediate dollar equivalent of the order of one million is usually considered as being appropriate for nuclear power plant VIAs, although larger values are now being considered by the NRC for use in its regulatory analyses.

Inherent in safety regulation is the need to compare the postulated benefits of averted accident consequences to the real costs and occupational hazards associated with the implementation of proposed modifications. This involves the comparison of uncertain or probabilistic components of value against more certain (i.e., predictable) components of value. The use of standard economic analysis methods such as discounting of future benefits seems to be accepted as the most valid means of addressing this particular issue [**13**], although it also engenders controversy because of the perception by some that discounting the value of future reductions in dose or public health effects "cheapens" the value of life. One means of dealing with this last objection is to neglect discounting for those impacts that deal directly with health effects, on the basis that this decision will be a "conservative" one from the standpoint of safety.

The need to make judgements to facilitate the quantitative comparison of uncertain benefits with the more predictable benefits can be viewed both as a weakness and as a strength of risk-based VIA. It is a weakness because of the need to make such value judgements; it is also a strength because such judgements are indeed the essence of safety-related decision-making and, therefore, should be prominent in the decision process. One judgement of this type that has been introduced in Canada [**8**] but which has received little attention in the United States is the extent to which the indirect costs of the health effects of replacement power sources are included in nuclear plant VIA. Current estimates suggest that the environmental effects of fossil power plant operation are at least ten time larger than those of a comparably sized nuclear power plant [14]. If the cost of implementation of a nuclear safety modification includes a special, or specially-extended, plant shutdown with replacement power provided by fossil units, the anticipated health effects of additional fossil plant operation can become the dominant detrimental effect in the VIA. The lesson is clear: minimize the length of the outage required for the modification, or assure that the source of replacement power is environmentally benign relative to nuclear.

Contextual Issues

In a decision context where a number of parties contribute to and can be affected by decisions, VIA can be a very effective method for incorporating the relevant objectives of each party and for demonstrating the contribution of each party's objectives to the decision. The multi-party regulatory regime in which Canadian and U.S. utilities must operate nuclear power plants is just such a decision context. Many decisions made in this context may have significant safety, cost, and other impacts, and will affect the allocation of the limited industry and regulatory resources available to address safety issues. It is in the best interests of the public that the industry and its regulators make all such decisions objectively, efficiently, and scrutably. The use of VIA supports the achievement of these objectives.

Three of the more significant contextual issues that can affect the expanded application of VIA for coordinated safety decision-making are:

- the perceived need for organizational independence and control;
- the potential incompatibility between the use of VIA in safety decision-making and the existing regulatory framework; and
- the natural tendency of regulators to seek continual improvements in safety.

Independence and Control. Both the AECB and the NRC are legally required to maintain their independence from those being regulated. To be effective, they must also maintain the public's confidence that they are indeed independent from and capable of controlling the members of the regulated class. From long experience, utilities have also developed means to work within the existing regulatory and political environment. At least in the U.S., utilities and the NRC have become accustomed to operating somewhat independently in the management of safety and regulatory issues, and the coordinated use of VIA to support the decision process may require a departure from the usual organizational modes of operation.

The results of risk-based VIA for nuclear power plants often challenge subjective notions held by regulators and utility personnel concerning the safety benefits of proposed regulatory actions. In many instances VIA results that do not support the implementation of proposed alternatives for regulatory action are obtained. Often, this is because of defects in the process used to identify alternatives for action, not because of limitations in the PSA or VIA methods used to assess them. In such cases there is a tendency for regulators to insist upon the implementation of one of their proposed actions, regardless of merit, because any other outcome (e.g., adoption of a course of action proposed by the utility) could be interpreted as a loss of regulatory independence.

A second issue that can affect the successful use of VIA in a coordinated decision-making mode is the perceived need of both regulators and utilities to maintain a certain degree of "control" (real or perceived) over their own safety management processes. For example, in ISAP II, the NRC offered U.S. utilities the ability to better manage the implementation of safety-related modifications through the application of risk insights derived from PSA results. To obtain a number of not inconsiderable advantages (plant specific evaluation of proposed regulatory actions, scheduling implementation of safety modifications by merit and resource availability, and elimination of proposed regulatory actions of demonstrably limited safety benefit) utilities were asked to commit to participation in ISAP for the remainder of plant operating life and to accept a license modification incorporating ISAP. The ISAP license modification provided the NRC staff with the degree of enforcement capability it deemed necessary to "control" the safety management process. However, it also exposed the utility to intervention whenever a change in the conditions of that part of the license would be required, which was perceived on balance as an acceptance of a significant increase in regulatory uncertainty - a possible loss of control over the process of safety management for the utility. It was the inability of both the NRC and utilities to accept certain limitations in their existing degree of control over the safety management process, perhaps more than any other factor, that was responsible for the abandonment of the ISAP concept.

There is another related "control" issue that can also affect the potential for the coordinated application of VIA in nuclear safety decision-making. This involves the means by which agreement is reached on the models, methods, and data to be used in evaluating proposed regulatory actions. In the U.S. VIA is often used by the NRC staff during a regulatory analysis, consistent with the agency's Regulatory Analysis Guidelines [15], which incorporate VIA methodology by reference. The Committee to Review Generic Requirements (CRGR) is expected to use cost-benefit analysis and the results of PSAs, where appropriate data are available, to support its review of proposed regulatory actions [16]. "Generic" VIAs using risk estimates obtained from one of the many PSAs available to the staff are prepared in support of a proposed regulatory action. Regulatory actions affecting a class of plants may be approved on the basis that both a substantial safety improvement is anticipated and the generic VIA, if performed, shows a cost beneficial result. However, objections are often raised to the applicability of a generic VIA result to individual facilities on one or both of the following bases:

- the VIA was incomplete or incorrect in that it improperly accounted for costs, combined values and impacts improperly, or used inapplicable decision attributes;
- the risk analysis results used to quantify the VIA models were derived from incorrect data, inapplicable models, or improperly defined competing risk situations.

Utility applications of VIA seeking to justify exemption from a regulatory requirement are often subject to similar objections. It would be in the best interests of both regulators and utilities to agree upon a specific set of guidelines for preparing VIA. This is imperative if a coordinated industry decision-making process that applies VIA is to be finally achieved.

Because the viability of each proposed safety action is dependent upon local economic factors and the specifics of plant design and operation, both of which vary considerably from plant to plant, it seems reasonable to prefer the use of plant-specific models and data in VIA. The increasing availability of plant-specific PSAs for Canadian and U.S. nuclear facilities makes it feasible to argue for their use in preference to any "generic" analyses of this nature.

The NRC staff remains concerned about the comparability of results from the different PSA methods and modeling techniques used by licensees in responding to the IPE requirements. It is not possible to assess the degree of variability in VIA results that could occur from these differences; it does not, however, seem likely that such variability would disqualify VIA results any more than would the use of generic risk analysis results, even those derived from NRC-sponsored and maintained PSAs such as NUREG-1150 [17].

<u>Applying VIA Within the Existing Regulatory Framework</u>.

Neither utilities, as a group, nor their regulators have yet developed effective measures for systematically incorporating the results of PSA and VIA into the regulatory decision-making process. Most of the existing regulations were developed prior to the availability of methods for quantitatively evaluating their contributions to risk reduction; indeed some regulations by their very nature may never prove amenable to the quantitative expression of their risk reduction potential. Agreement on the basic means of using risk information in concert with existing regulations is necessary before the coordinated application of VIA can become an effective safety decision-making means.

As an example, Ontario Hydro has incorporated VIA into its policy regarding the backfit of safety improvements to older stations, and into its safety goal philosophy as a means of assessing the merits of proposed design modifications. But the AECB has not yet accepted the validity of Ontario Hydro's VIA results as a basis for regulatory action.

Continual Safety Improvement (How Safe Is Safe Enough?). Although it is generally accepted that existing U.S. and Canadian nuclear plants are adequately safe, both the AECB and the NRC have undertaken many initiatives to improve the safety of operating nuclear power plants and to obtain additional safety margins in the new reactor designs being proposed. The justification for seeking continuous improvement in safety lies both in the legal mandates, which clearly avoid establishment of static definitions of adequate safety, and in society's continuing demand for diminished nuclear risks, which regulators translate into a demand for greater levels of plant safety. To a degree, it is also associated with the present uncertainty in risk reflected in the outcomes of PSAs.

There is a point beyond which efforts to improve nuclear plant safety by implementing specific design changes, especially in operating plants, will be unjustifiably expensive for the societal benefits obtained. Resources that would be used to obtain marginal improvements in public safety can then be used to obtain greater benefits for society in other areas. VIA can help identify this point. What cannot be accomplished by VIA is the definition of the level of risk (or safety) above which cost-benefit considerations are not applicable. This must be established separately, by political action or through promulgation of acceptable risk levels and safety goals by regulatory agencies.

In Canada, the position of the AECB on the degree to which an acceptable level of safety has been attained in operating Canadian nuclear plants is not formally stated, but recent history clearly indicates that the Board will insist on design modifications even in situations where all licensing requirements have been fully met. Ontario Hydro has established an internal safety goal policy that sets quantitative risk targets, below which safety adequacy is assumed, and risk limits, above which remedial action must be taken. In between, design modifications aimed at risk reduction may be considered in the context of VIA [18].

In the U.S. there is no quantitative definition of the minimum acceptable level of safety required for nuclear power plants. The USNRC in 1986 promulgated its Safety Goal Policy Statement, which provided a set of qualitative and quantitative health objectives for the operation of nuclear power plants. At issue currently is whether these safety goals define the level of safety beyond which no increase in safety should be sought by regulatory action, or whether they define only a minimally acceptable level of safety against which "substantial improvements" in safety should always be considered and implemented when deemed societally cost-effective. The outcome of this discussion will obviously affect the degree to which VIA can be used in determining the viability of proposed regulatory initiatives.

IMPROVING THE PROSPECTS FOR COORDINATED USE OF VIA

The preceding discussions have identified a number of issues that may limit the potential effective use of VIA methods in nuclear industry safety management, particularly as a joint endeavor between regulatory agencies and utilities. Even with its acknowledged limitations, VIA is arguably the best available tool for achieving consensus among regulators and utilities on important nuclear industry safety and economic issues. If properly structured and applied, VIA can provide utilities with a basis for examining and defending their economically-motivated initiatives, even as it offers regulators a means of objectively characterizing the safety benefits and the economic prudence of proposed regulatory actions. Perhaps more importantly, VIA also provides a common framework through which all affected parties can better understand one another's objectives and motivations, and a means to obtain reasonable compromises on safety and economic objectives that benefit society overall.

It is obviously foolhardy to attempt to prescribe a detailed program for assuring agreement between regulators and utilities on the means for applying VIA in any particular regulatory context. It may, however, be appropriate to provide a few suggestions based on the authors' collective experience in developing and using VIA methods.

The oft-repeated advice of a prominent athletic shoe company may be most applicable: just do it. First, however, there must be recognition of and acceptance by both regulators and utilities that consistent use of VIA improves the prospects for coordinated safety and economic decision-making. Given this, a working group including representatives from utilities and regulators can proceed to outline an approach for applying VIA in managing safety and prudence issues, similar to that used in the past in the U.S. for developing improved and simplified technical specifications. Such an effort would first seek to identify the key issues that have restrained the effective application of VIA in the past, and then would develop specific recommendations for resolving each issue.

Of the two basic types of issues affecting the potential for successful application of VIA in nuclear power plant safety issue management, it is the authors' belief that the contextual issues will be the most difficult to resolve. U.S. experience with the ISAP program, as reported above, clearly supports this view. The key concerns have all been noted previously and each must be addressed if expanded and more effective use of VIA is to be achieved.

It has already been noted that the most important methodological issue affecting the use of VIA is the formulation of the competing risk situations that exemplify the initial and hoped-for final states of the systems to be improved. Both utilities and regulators would benefit from the development of a systematic and scrutable method for defining competing risk situations.

Another critical element affecting the use of VIA in the safety management process is the development of effective proposals for regulatory action for acknowledged defects in safety or regulatory requirements. Although not formally a concern of VIA (because VIA is applied only after such alternatives for action have been developed) it will have a substantial effect on the potential usefulness of VIA for managing the safety and economics (prudence) of utility nuclear power plant operations. If VIA is presented with a set of alternative actions, none of which is capable of addressing the particular safety defect of interest satisfactorily, this will be made clear in the outcomes of the individual evaluations. There is a risk associated with this type of result, however. That risk is the potential for causing or increasing the perception that the VIA method itself may be flawed, rather than the alternatives presented for analysis. The importance of having a robust method for developing alternatives for regulatory action is thus underscored.

Coordinated application of VIA by utilities and regulators has the potential to provide improved safety and more effective use of resources within the nuclear industry. To achieve these objectives, all organizations involved will have to accept changes in their present modes of functioning within the regulatory environment.

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