

February 27, 2003

MEMORANDUM TO: Cynthia A. Carpenter, Chief
Inspection Program Branch

FROM: Doug Coe, Chief */RA/*
Reactor Inspection Section
Inspection Program Branch

SUBJECT: THE FUTURE OF RISK-INFORMED THINKING

This memorandum is written with the hope of better informing the decision on how this agency should respond to and move forward from the recommendation made by the Significance Determination Process (SDP) Task Group to replace the current reactor safety "phase 2" process with a pre-solved table representing only the face-value results of this process. While I greatly respect the effort and work that went into the Task Group's deliberations, their final report does not address the significance and future implications of this central recommendation. I respectfully request that the following views and the alternative approach described in the attachment be made available to agency management who will concur or approve the final decision on responding to the SDP Task Group recommendations.

Although I have helped to guide the development of the risk-informed SDPs, I wish to be very clear that I am not writing from a parochial perspective. If a better means existed to achieve the goal of generally improving our internal stakeholders' understanding of the value and limitations of each probabilistic risk analysis (PRA) used to inform our decisions, then I would be the strongest advocate of adopting that means. My concern lies fundamentally with the standard of intellectual excellence we apply within our decision processes, now more than ever laid open to both inside and outside scrutiny under the Reactor Oversight Process (ROP). The need for clearly defined intellectual standards and the tools to meet them is particularly acute when our decisions utilize a methodology such as PRA, that is so ambitious in its attempt to mathematically model the enormously complex realities of a nuclear power plant. The use of a pre-solved "look-up" table to completely replace the current phase 2 process will not engage anyone in the process of risk characterization at a level expected to contribute to their understanding of probabilistic risk.

The principal value of the SDP and one of its objectives is to provide a commonly available communication tool exercised directly by inspectors and whose influential assumptions and logic could be understood by inspectors, agency supervisors, managers, technical staff, and by licensee staff, who have relevant knowledge and perspectives to bring the significance characterization process. As much as we might want the risk-informed SDPs to be "answer machines" that quickly and consistently make our significance determinations easy, that will never occur due to the very nature of PRA. The inspector's initial use of any probabilistic risk tool will always be the start of an iterative deliberation process that should be aimed at achieving an increased collective understanding and acceptance among the decision stakeholders as the SDP result becomes appropriately influenced by relevant knowledge and deliberation. This was the seminal insight of the 1996 National Research Council study panel

report¹ entitled “Understanding Risk - Informing Decisions in a Democratic Society.” Improving the efficiency and timeliness of the SDP is directly dependent upon this increased collective understanding and the resulting level of acceptance it ultimately brings to thinking within a probabilistic framework.

The SDP objective is stated in terms of communication, the inferred goal is to facilitate dialog and greater understanding to better inform the decision result and the decision stakeholders. Although no panel, task group, auditor, or other individual has disputed the merits of the above goal, all have been silent on how understanding must be achieved through the use of risk communication tools and through insistence on an investment of some degree of intellectual effort on the part of all decision stakeholders with relevant knowledge or interest. The central question is how to best define and require such an intellectual standard, as an intrinsic aspect of the SDP. The SDP Task Group recommendation to replace the current phase 2 process derives from the view that “inspectors want something simpler” without acknowledging the inherent conflict of this view with the effort needed to grasp and understand, at some defined level of detail, the complexities of the technical and probabilistic assumptions being made. In addition, the Task Group appeared to give substantial weight to inspector comments that the current phase 2 process was too difficult, even though SDP self-study training was given in Spring 2002 to 267 inspectors who then scored between 60 and 100 (average 74.5%) on a 25 question test.

It is easy to invest greater faith in professional risk analysts and in their use of risk models of greater complexity (i.e., let them do most of the “risk thinking” for us). This will be one of the consequences of accepting the recommendation of the SDP Task Group. I submit this is unequivocally the wrong answer. If our goal is to act, both as individuals and as an agency, in a risk-informed manner, then we must each understand probabilistic risk to the extent that we can see what it is telling us, so that we can understand what it is not telling us (i.e., its limitations). This is the added burden we must bear to be truly risk-informed. The attributes that must be in place to achieve this goal of individual and collective risk-informed understanding are:

1. Commonly available risk communication tools

Currently such tools exist at three different levels for different users: 1) Detailed computer-based risk models for analyst use, 2) the risk-informed SDPs for technically knowledgeable non-analyst use, and 3) the SDP color scheme for general public use. None of these tools are yet “complete” and each one should continue to evolve and improve to serve its specific customers.

2. An open and scrutable process

An open forum and dialog, both within the staff and ultimately in public, is facilitated among individuals with disparate technical backgrounds and knowledge through the use of the commonly available and understandable risk communication tools.

¹ National Research Council, National Academy of Sciences; “Understanding Risk - Informing Decisions in a Democratic Society,” (1996)

3. A commitment to objectivity

This commitment must be an acknowledgment on the part of all decision-makers and stakeholders that the judgements and assumptions that are inherent in all probabilistic risk analyses will not be biased purposefully with intent to render a desired result. This is the essence of the discipline that using probabilistic risk thinking brings to decision-making.

Each of these attributes depends upon its predecessor, such that the quality (i.e., acceptance) of the resulting decision flows from the objectivity ensured by the openness of the process and made understandable through the use of common risk communication tools. The risk communication tools are thus at the very foundation of achieving quality in the resulting decision. Our vulnerability to losing objectivity will continue, as there have been (and I expect will continue to be) decision stakeholders who have revealed their desire to see certain specific SDP outcomes achieved regardless of how.

We are at a turning point for the future of risk-informed thinking, although I do not believe this is widely recognized. At stake is whether we continue to maintain an explicit intellectual standard for our non-analysts as it applies to our use of probabilistic methods, and provide the programmatic means and tools to achieve it. Accepting the recommendation of the SDP Task Group to replace the current phase 2 process with a pre-solved table is wrong for the following specific reasons:

1. It perpetuates the myth that only risk analysts should do risk analysis and that a risk model is an “answer machine” instead of what it really is: a thinking framework. The role of the analyst must not just be to produce the risk analysis, but as a priority must include assisting others in understanding the basis for the analysis.
2. It removes the current means to improve risk understanding among non-analysts without offering an alternative to address this point. Training alone will not sustain knowledge or understanding unless there is a programmatic requirement to utilize that training and tools are provided to do so. Further, if high expectations are not set, people will never evolve to a higher level of knowledge and understanding.
3. If no standard of understanding is set for inspectors, then neither will any be set for management decision-makers. A senior agency manager recently commented that few persons attending a SERP really seemed to understand the risk basis for the SDP result being presented. His insight was accurate. Current program requirements require that the risk basis be presented at the SDP and Enforcement Review Panel (SERP) using the phase 2 tool where applicable. Programmatically removing the requirement to use the phase 2 tool will remove the only standardized plant-specific tool currently available to provide the opportunity for non-analysts to understand the risk basis of an applicable SDP result. We clearly need to continue to press forward, not backward, in moving to solidify our expectations for risk communication and understanding.
4. It ignores the fact that the cost of risk-informing people is paid in the currency of personal and individual intellectual effort. Risk-informing people will never result only from spending dollars for ever more detailed risk models, or peer reviews of

risk models, or more standards for risk models, or even more training. This is because the quality (i.e., acceptance) of a risk-informed decision is directly proportional to the number of decision stakeholders who understand and accept its underlying influential rationale and assumptions, its sensitivity to these assumptions, and its limitations relative to each specific situation. I have a deep affinity for the enormous day-to-day challenges faced by reactor inspectors and understand that being risk-informed is an added burden. But logically there should be nothing more important to a reactor inspector than understanding the safety/risk context of a plant's condition as the means to identify the most significant findings.

In summary, every action we take to invest greater faith and confidence in detailed mathematical risk models is a step away from expecting and providing for greater understanding among a greater population of decision stakeholders. To be risk-informed as an agency, we must be risk informed individuals. We must also constantly renew our commitment to a high intellectual standard, to inviting all relevant knowledge and perspectives to our decision processes, to conducting our deliberations in an open, understandable, and objective manner and to develop and improve risk communication tools that provide the infrastructure to achieve these goals. The job description of risk analysts must include a priority task to facilitate real risk understanding among decision stakeholders. The job description of risk-informed decision-makers must include an equal commitment to real risk understanding. The SDP Task Group recommendation removes the current expectation for non-analysts to use the only existing risk communication tool currently available to achieve those goals.

This agency has always been at the cutting edge use of the analytical side of probabilistic risk methods. We must turn our attention now toward improving risk thinking and risk communication, not just risk models. The nuclear industry follows our lead and the future of risk-informed thinking is in our hands. Our leadership in this arena must be based on a clearly stated philosophy and commitment to continue to demand intellectual excellence of ourselves as well as our licensees. I believe that the timing is crucial, as we are on the cusp of institutionalizing a defined standard of excellence in understanding probabilistic risk within our population of technically knowledgeable non-analysts. We must seize this opportunity to exercise firm technical leadership. Faltering or waffling now will only delay achieving the inevitable and necessary future of risk-informed thinking in this agency.

Attachment: As stated

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Alternative Proposal for the Phase 2 process:

1. Consider providing inspectors with simplified plant analysis risk (SPAR) model risk assessment worth (RAW) values and three factor formula for immediate use (minimal cost initial substitute to SDP Task Group recommendation).
2. Complete notebook benchmarking (per SDP Task Group) and create pre-solved tables, but do NOT include explanatory comment column. Basis for this is that such text descriptions of risk importance have been tried before (e.g., RIGs) and have not been successful. Replace applicable questions in the Phase 1 screening process, for findings affecting mitigating systems, with use of the pre-solved tables.
3. Do NOT replace the current Phase 2 process or the expectation that if a finding screens past Phase 1 that the inspector develop and understand the Phase 2 basis and submit it to the SRA for further evaluation and checking.
4. Develop and implement explicit guidance on the specific Phase 2 assumptions inspectors should specifically check and verify for accuracy or reasonableness.
5. Invest some \$\$ or resources (e.g., summer co-ops, interns) in developing spreadsheet versions of the risk-informed inspection notebooks, to ease the mechanical burden of exercising the Phase 2 worksheets while retaining the expectation that the user will understand and evaluate the reasonableness and accuracy of the assumptions being used.