Risk-Informing the Nuclear Materials and Waste Arenas

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The purpose of this paper is to report significant progress in the development of the use of risk analysis and information in the non-reactor areas of the nuclear enterprise that is regulated by the U.S. Nuclear Regulatory Commission (NRC). For the past quarter century, probabilistic risk assessment has been used to help guide safety and operational programs for commercial nuclear power plants that generate electricity. The non-reactor areas that NRC regulates includes all other aspects of the nuclear fuel cycle as well as medical and industrial applications of nuclear science. Risk insights and information could improve the way the NRC Office of Nuclear Materials Safety and Safeguards (NMSS) manages its regulatory processes: rulemaking, licensing, inspection and enforcement [1, 2].

Beginning in February 2001, eight case studies were conducted of specific facilities (decommissioning, uranium recovery, and uranium enrichment, gas chromatographs, static eliminators, fixed gauges, transportation of the Trojan vessel package, and TMI-2 fuel debris storage exemption) to gain insight on how these and other areas have been and potentially can be risk-informed. These studies involved site visits, analysis, and participation in meetings with stakeholders. The case studies were designed [3] to meet the following objectives:

(1) Test draft screening criteria for determining whether a regulatory issue or licensing action could be risk-informed and produce a final set of screening criteria.

(2) Gain insights into risk-informing NMSS regulatory processes.

(3) Determine the feasibility of developing safety goals

(4) Identify gaps in tools, methods, data, and guidance that are required to risk-inform NMSS.

Overall, the case studies demonstrated that the screening considerations contained all the relevant elements needed for risk informing and that risk information has been used for some time in making regulatory decisions. The case studies were effective in indicating where decisions or processes are consistent with the Agency's strategic goals and they have helped to highlight some of the areas in which there are shortcomings in the regulations or regulatory process. Risks to the workers have been found to be significant in comparison to public risks. For some facilities, chemical risks have been found to be comparable to or greater than the radiological risks.

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Information, tools, methods, and guidance needs have been identified and the necessary tools can be assembled to make the risk-informing process more effective. There is a fairly significant application of risk methods and applications in some areas and somewhat less experience in other areas. One of the major gaps in the methods is the identification and development of a robust and simple method for incorporating human factors and estimating human reliability in the very wide range of situations and activities encountered and performed by NMSS licensees. A draft guidance document has been developed for performing risk analysis for the various materials and waste applications.

The studies also showed that safety goals are feasible and decision-making and risk management can be facilitated if a clear set of safety goals existed. Safety goals for the materials and waste arenas that are analogous to the reactor safety goals are under development. Potential safety goals that follow the general structure of the safety goals for the operations of nuclear power plants are as follows:

> *Individual: Nuclear materials use and disposal do not pose a significant additional risk to life and health of individual members of the public, and to workers associated with these activities.*
>
> *Societal: Societal risks to life and health from nuclear materials use and disposal are not significant additions to other societal risks, and the benefits of the use greatly outweigh the risks.*

The property damage goal that also includes an environmental damage goal is expressed qualitatively as follows:

> *Property/Environmental Damage: Nuclear materials use and disposal should not result in environmental or property damage in excess of other means of achieving a similar end objective that is deemed beneficial to society.*

Second tier quantitative objectives that support these goals can be defined in terms of small percentages of comparable risks that individuals and society encounter. Proposed examples of these will be given in the presentation. Third tier subsidiary objectives are essential elements of a risk management program because they are the figures of merit that can be most directly estimated with regard to the intention of the safety goals. For example, in the case of nuclear power plant operation, the subsidiary objectives are the core damage frequency and the large early release frequency. Subsidiary objectives for the materials use and disposal areas can be defined in terms of the engineered features of the classes of facilities involved and the likelihood that failures of these features will occur and these will be illustrated in the presentation.

An important adjunct to risk information when used for managing risks is a set of safety goals that assist the decision maker in determining whether safety objectives will be achieved. If safety goals are to move forward, then risk information can be readily compared with these goals to guide and inform regulatory issue resolution.

Risk information can be valuable as an additional input to decisions that NMSS must make. It can complement the more familiar information that is derived from consideration of the existing regulatory framework. It can help to make that framework more rational. An integrated and balanced risk management program would recognize both public and worker risks as well as

radiological and nonradiological risks at the regulated facilities.

References

1. US NRC, SECY-99-100, "Framework for Risk-Informed Regulation in the Office of Nuclear Material Safety and Safeguards," March 11, 1999.

2. US NRC, "Staff Requirements Memorandum - SECY-99-100 - Framework for Risk-Informed Regulation in the Office of Nuclear Material Safety and Safeguards," June 28, 1999.

3. US NRC, Case Study Plan and Revised Draft Screening Criteria, Federal Register, 65 FR 54323, September 7, 2000.