Best Practice – Stakeholder Engaged Structured Decision Making

Facility: All (EM and NNSA)

Best Practice Title: Stakeholder Engaged Structured Decision Making to improve performance and reduce costs while protecting human health and the environment

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Brief Description of Best Practice: The overall objective of this Best Practice is to introduce a paradigm shift in approaches to decision making for nuclear waste management, disposal and remediation decisions. The stakeholder-engaged structured decision making (SDM) paradigm shift provides a transparent framework for developing optimal solutions to complex problems (Keeney, 1992, Gregory et al, 2012).

This is a deliberative-analytical process. The deliberative part addresses understanding stakeholder values and concerns, developing objectives from those values and concerns, and identifying options that might achieve those objectives. SDM is implemented through computer tools that are aimed specifically at capturing these deliberative aspects of a decision analysis. The SDM process and tools capture this deliberative information in a structured system that formalizes and memorializes the values and concerns, objectives, weights for the objectives, and options that have been identified. This approach provides transparency, traceability, and reproducibility. The goal of SDM at this stage is to provide a formal structure for capturing the deliberative information.

The deliberative part sets the stage for the analytical part of SDM. A variety of Subject matter experts (SMEs) are engaged in how to evaluate the options through the objectives. Objectives often include minimizing human health risk and minimizing cost, but in the full scope of a sustainability-based approach to decision making, it can include objectives related to economic, environmental and social issues. Subject matter experts might provide other options for achieving the objectives, but their primary role is to evaluate/model the options to the endpoint defined by the objectives or in other words perform a consequence analysis. The structure of SDM makes it clear exactly what is needed from the SMEs, because the options are identified, and the endpoint (objectives) are defined – evaluations and/or models are needed to connect options to objectives. This consequence analysis completes the evaluation, and directly addresses which of the options is the best option. The same SDM approach to finding the best options can also be used for prioritization and resource allocation.

Because all of the information is captured in a formal system with the help of computer tools (a software framework for implementing SDM), the decision models that are developed for an application can be fully evaluated numerically and for the insights gained from using a formal process for managing the multiple factors that need to be considered for complex decisions. This includes uncertainty and sensitivity analysis that can be used to guide the need for further data/information collection if the optimal decision is not adequately supported – that is, if there is insufficient confidence in the decision. Also, this feeds directly into adaptive management therefore if more data/information are collected then the efficacy of the current decision can be evaluated, potentially leading to a change in decisions if warranted.

Why the best practice was developed: This best practice has been developed for two primary reasons. The first is a recognition that many of the remaining waste management and environmental management problems in the complex are likely to be challenging and that the current approach that has, arguably, worked well for relatively simple problems cannot, or should not, be applied to more complex problems. The second reason is cost. This has perhaps become more critical since the GAO recently announced that DOE's environmental liability is a high-risk concern, but has been a concern for DOE for some years. The SDM approach has the potential to substantially reduce costs while maintaining protection of human health and the environment as required under various environmental regulations. The cost reductions come from three factors: One is the engagement of stakeholders in this manner reduces the need for rework; The second is the approach is a technically correct method for solving decision problems using decision analysis, which removes the types of conservatism that plague current practice for environmental assessments of various kinds; The third is that options can be identified with stakeholders that are not always found by practitioners alone, and sometimes these are more cost-effective solutions.

There is no guarantee that applying SDM will result in reduced costs for every application, but the level of conservatism that is inherent in the current environmental assessment systems for nuclear/radioactive issues is sufficiently large that reduction in conservatism, and usually cost, is not difficult to achieve. Note that cost reductions are not always immediate. For example, if waste disposal is the decision problem, a large disposal volume can be filled for a long time before the current approach will cause the cell to be filled sooner than necessary. In effect, SDM plays directly into a long-term sustainability based analysis, or life-cycle analysis.

Although this SDM approach is an innovation, it can also be viewed as the modern, correct, implementation of EPA's Data Quality Objectives (DQO) process, although classical DQOs are aimed only at design and without focus on completion of the decision cycle. Applying the DQO process has always been challenging for complex problems because the technical paradigm associated with DQOs did not support decision making that integrated values with the technical data/information associated with complex problems. The underlying formalism of SDM overcomes those limitations and effectively operationalizes the DQO process. SDM also aligns with the requirements of OMB's approach to evaluating the economic impact of regulatory and policy decisions, providing further evidence that DOE should adopt SDM to support decision making.

What are the benefits of the best practice: This paradigm shift to SDM is needed to provide greater technical defensibility for solving complex problems, and for reducing costs. Benefits include effective engagement of stakeholders in the decision making process, use of the SDM structure to clarify the modeling needs and engagement of SMEs, and the ability to evaluate the decision system, or model, to determine what's important in driving the decision.

Benefits gained from the formalism of applying SDM using the software tools that are associated with this system include technical defensibility, transparency, traceability, and reproducibility. The time scale of the problem, the evaluation, the decision and the eventual completion are such that often the principal parties change and a means to ensure continuity is highly desirable. These are critical QA requirements that should support any decision that is being made for a complex problem. In addition to these QA aspects, the SDM tools are embedded in a web-based system that provides sharing of data, information and models, presentation in a user-friendly environment, visualization of data and models, and other features related to understanding the decision problem.

The primary benefits for nuclear waste management, disposal and remediation decisions will be realized in the reduced costs and schedule to achieve the mission of DOE to clear its current environmental liability.

What problems/issues were associated with the best practice: Problems with the SDM paradigm shift are associated primarily with lack of capacity in the industry to implement this approach. This approach requires skills that have not often been used in the industry, such as stakeholder engagement experts, elicitation experts, decision analysts, and statisticians. Scientists and engineers still have a critical role to play as SMEs, but their role is supporting a decision analysis, which needs its own set of skills. The industry has moved towards probabilistic risk assessment (performance assessment), which is also embedded in SDM approach, but also requires skill sets that the industry has not needed in the past. Capacity building and training become important aspects that must be developed in order to maximize success in this approach.

How will success of the Best Practice be measured: Success is not always easy to measure in this approach because, usually, only one solution to a decision problem is usually implemented, so comparison is not often straightforward. However, there are some possibilities:

1. In some cases it is possible to compare the results of using this approach to a pre-planned alternative for a specific application
2. If a pre-planned alternative is not available, it is possible to question the stakeholders about the likely benefits of the optimal solution found through SDM to a solution that might have been taken otherwise (retrospective comparison).
3. The options that are processed through an SDM application can be compared directly, so relative cost savings among those options can be measured.
4. Feedback can be sought from the participants (stakeholders and SMEs) on the benefits of the approach, which can include much more than cost-related benefits.
5. Continuous improvement approaches can be used to learn lessons from each application, to improve the SDM process.
6. The biggest impact can be seen collectively across the industry, particularly considering current estimates of DOE's environmental liability. Comparisons can be made as projects are completed to evaluate the cost difference. Other benefits can also be captured that, for example, demonstrate that human health and environmental protection have been achieved.
7. Elimination of rework, negotiation of lower cost, and shorter duration remedies also provide insight into the features and benefits that are realized through the implementation of SDM.

Conclusion/Summary: SDM is a powerful new tool and approach to solving complex decision problems. For the complex nuclear waste management, disposal and remediation decisions that remain within DOE's realm, a paradigm shift is needed that has the potential to dramatically decrease costs while maintaining protection of human health and the environment, and also addressing other objectives that might be important to stakeholders (e.g., quality of life, jobs, economy). The potential benefits are large in terms of:

1. Useful and effective stakeholder engagement that feeds structured decision making.
2. Technical defensibility, transparency, traceability and reproducibility, so that if the decision is revisited after some time all of the supporting information and analysis is readily available.
3. Decisions that are supported by all stakeholders who participated in the process. In effect, inputs are negotiated instead of outputs. This substantially reduces the chance or opportunity for redo.
4. Potentially large reduced long-term costs to the nuclear waste management, disposal and remediation decisions.

The current approach to addressing nuclear waste management, disposal and remediation decisions is affecting upstream decisions related to nuclear industries, including nuclear energy. Arguably, the Country needs a nuclear energy industry to provide clean energy at low cost, and to compete economically with countries such as China that are moving ahead full-steam with nuclear energy to replace fossil fuel as a source for energy. SDM is the paradigm shift that is needed to provide the technical defensibility, stakeholder agreement, and lower costs that are needed while still protecting human health and the environment. Consequently, EFCOG recommends use of this approach to address the complex nuclear waste management, environmental remediation, and nuclear decommissioning decision problems that remain.

References

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