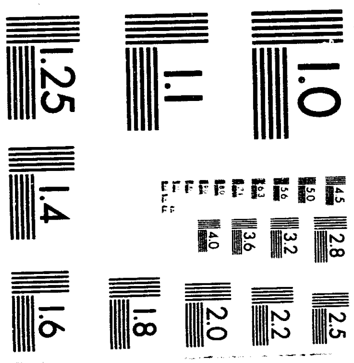

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MANAGING RISK AT HANFORD

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MANAGING RISK AT HANFORD

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Introduction

Department of Energy Headquarters (DOE-HQ) and the Assistant Secretary for Environmental Management have increasingly emphasized the importance of considering risk in DOE decisions. This emphasis is well placed, for, as noted by the Environmental Protection Agency in 1991 (EPA Science Advisory Board and Office of Technology Assessment Report), "DOE lacks a sufficient basis for evaluating States' health and environmental risk." Secretary of Energy Hazel O'Leary's input to President Clinton's 100-Day Report of April 30, 1993, emphasized "developing new standards of health and safety for workers, citizens and the environment...." More importantly, the U.S. Congress (H.R. 2445) has directed that DOE provide a description of the health and environmental risks posed by components of the weapons complex by January 1, 1995.

Assistant Secretary of Energy, Tom Grumbly, is responding to this mandate. In testimony to the Senate Committee on Energy and Natural Resources, July 29, 1993, he stated that the DOE intends to "complete a comprehensive survey of immediate exposure risks..." and "will be developing appropriate analytical tools for evaluating long-term risk..." In November, 1993, the National Research Council, at Mr. Grumbly's request, examined risk management in the DOE and reached consensus on the need for increased emphasis on risk assessment and risk management. Mr. Grumbly has moved quickly to integrate EM risk management and risk assessment activities, establishing in January of this year the Office of Integrated Risk Management (EM-6). The vision for this office is to consolidate existing risk information from across the complex and to add additional information to meet the congressional mandate and DOE-EM's decision-making needs.

Clearly, there is sufficient motivation from Washington for the Hanford community to pay particular attention to the risks associated with the substantial volumes of radiological, hazardous, and mixed waste at Hanford. But there is also another reason for emphasizing risk: Hanford leaders have come to realize that their decisions must consider risk and risk reduction if those decisions are to be technically sound, financially affordable, and publicly acceptable. The 560-square miles of desert land is worth only a few thousand dollars an acre (if that)--hardly enough to justify the almost two billion dollars that will be spent at Hanford this year. The <u>major</u> benefit of cleaning up the Hanford Site is not the land but the reduction of potential risk to the public and the environment for future generations. If risk reduction is our ultimate goal, decisions about priority of effort and resource allocation must consider those risks, now and in the future.

The purpose of this paper is to describe how Hanford is addressing the issues of risk assessment, risk management, and risk-based decision making and to share some of our experiences in these areas.

Risk Assessment and Risk Management

Hanford realized that a full set of risk information describing public, worker and ecological risks before, during and after completion of cleanup activities was essential to risk management. However, other inputs to the risk management process must be considered also, which leads to the definition of risk management we'll use for this paper.

(a) Pacific Northwest Laboratory is operated for the U.S. Department of Energy by Battelle Memorial Institute under contract DE-AC06-76RLO 1830.

Risk management is the activity which gathers and organizes information about an existing situation or a proposed action from hazard identification and risk assessments and communicates it, along with information about technical resources; social, economic, and political values; and control/response options to decision makers and stakeholders involved in a decision process. Risk management also includes the design and implementation of policies and strategies that result from this decision process.

Note that risk management, as we're considering it, uses information from risk assessments, those activities which actually generate the data. A major Site-level risk assessment effort is the Hanford Integrated Risk Assessment Program, which is described in another conference paper. A good way to think of the differences between risk assessment and risk management is that the former is the determination of risk data and the latter determines how to use those data in management and decision processes.

Risk Management Goals

The goals of the risk management program at Hanford are to provide managers at all levels with:

(1) a decision process which considers health and safety risk and other variables, such as cost, schedule, regulatory requirements, public acceptance, technological feasibility, organizational capabilities, and programmatic and security risk

(2) a procedure for communicating risk information to the public

(3) a procedure for allocating risk among subordinate waste management and environmental restoration programs

(4) a total picture of what risk information is available from programs

(5) a procedure for using risk information to resolve sitewide issues

(6) a procedure for setting priorities based, in part, on risk information

(7) a procedure for allocating resources based, in part, on risk information

(8) the ability to negotiate technical solutions with regulators based, in part, on risk

(9) the ability to track and communicate progress in terms of risk reduction

(10) a risk-based methodology to determine How clean is clean? and How safe is safe?

(11) the means to consider economic and political risks associated with cleanup and management decisions.

If these are the objectives of the risk management program at Hanford, our challenge is to determine how these objectives will be met. To understand the approach Hanford, the relationship among risk management, planning, systems engineering, and risk-based decision making needs to be explained.

Planning, Systems Engineering, Risk-Based Decision Making

Figure 1 illustrates how risk-based decision making will be implemented at Hanford. The figure shows how planning, decision making, and operations are related. Site management begins with development of a Site Strategic Plan, shown on the left. This plan contains the site vision, mission, and objectives. Planning continues with development of the Hanford Mission Plan and subordinate multi-year program and fiscal year work plans. Technical alternatives are developed and evaluated using systems engineering techniques, including risk characterization of options. The diamonds in the center of Figure 1 illustrate the decision process that converts plans into operations, and it is in this process that risk-based decision making occurs.

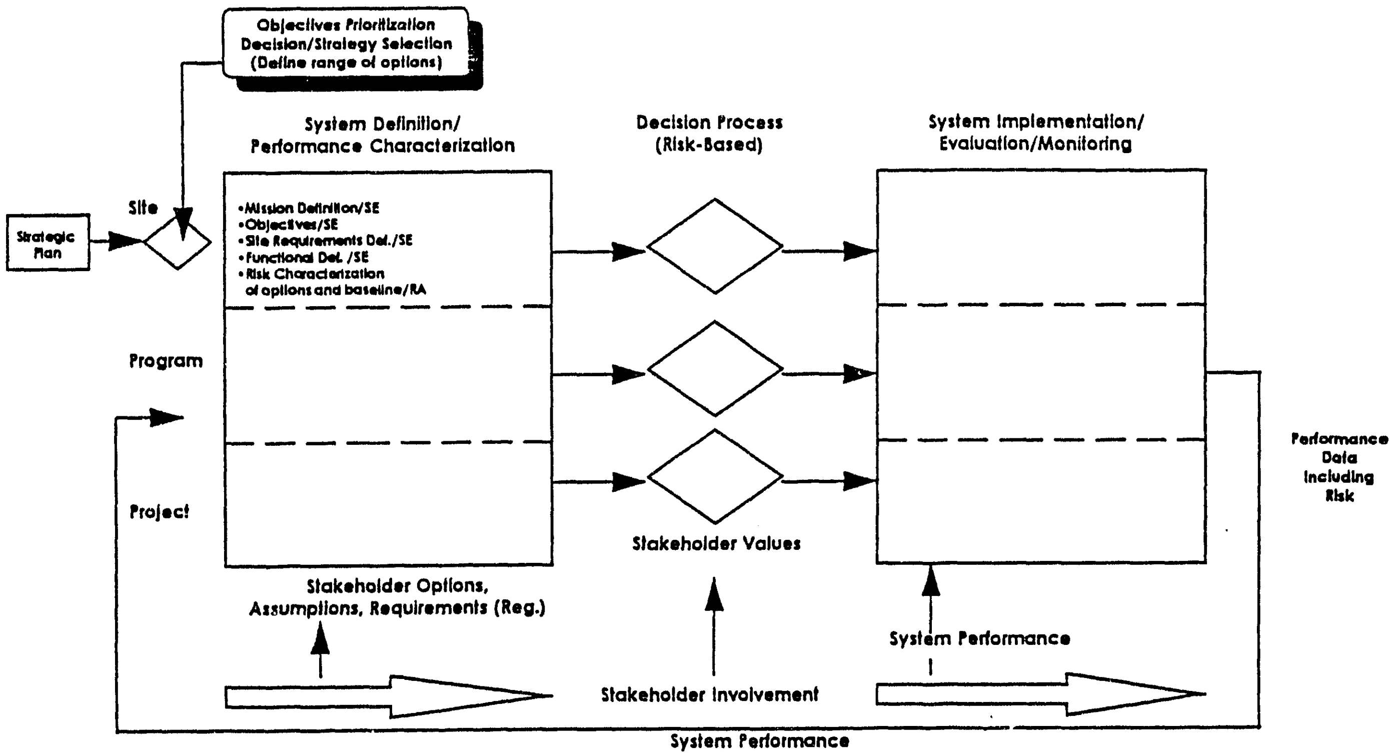

Figure 1. Hanford's Management System

Figure 2 is an example of risk-based decision making. The left column shows example inputs to a given decision, while the other columns illustrate technical alternatives. The inputs consider risk, cost, schedule, and other inputs, as shown. It is important to reemphasize that risk-based decision making considers many factors--not just risk--in making decisions. Moreover, there are several types of risk, in addition to the health and safety considerations we commonly think of. For example, programmatic risk includes uncertainties associated with execution of a given technical option. Risk management, then, must consider all uncertainties in the decision.

Options

Input Data	Technical Alt #1	Technical Alt #2	Technical Alt #3	
Environmental Risk				
Economic Data				
Safety and Health Risk				
Technological Uncertainty				
Stakeholder Values and Concerns				
Regulatory Requirements				

Figure 2. Example of a Risk-Based Approach to Decision Making

It may not be best to choose a decision rule that minimizes risk in every situation. We may, for example, prefer to reduce risk to a tolerable level, while minimizing costs or maintaining schedule milestones. Decision makers must establish the criteria for any given decision, and those criteria can change from decision to decision. Another factor, of course, is stakeholder input. Figure 1 shows stakeholders as being involved throughout the management system, with their values an input to the decision process.

An example of how decision makers could use the approach described above to address the question of allocation of resources to environmental restoration (ER) activities illustrates this point. Our risk studies indicate that the public health risk from contaminated soil and groundwater is minimal for many hundreds of years. On that basis, it could be argued that our ER efforts do not reduce risk very much and, perhaps, should be given lower priority. On the other hand, citizen groups, as expressed by the 1992 Hanford Future Site Use Working Group, made it clear that protection of the groundwater and the Columbia River from degradation was the most important objective of the cleanup. These two seemingly contradictory positions (little risk but high value) must be considered by Hanford (and DOE-HQ) leaders. Actually, any decision involving the groundwater and the River must include the public as participants.

Coordination of Efforts

Risk management, systems engineering, and risk assessment are three components of a single planning process, and a key challenge is ensuring that all related efforts are coordinated. This means that decisions which will be addressed as part of systems engineering must be identified early enough for the risk data which are needed for those decisions to be produced. Suppose, for example, the Tank Waste Remediation System program is considering two different technical solutions to a given problem, e.g., stabilization forms for low level waste. Ideally, risk, including programmatic risk, will be included in the choice. If risk data are not available, they will have to be generated--and that takes time, often a long time. This means managers must make their risk information needs known as soon as possible, and this includes the type, amount, accuracy, and format of the data. Similarly, data and data generation techniques can be shared among programs, as their common needs are identified.

Current Risk Management Efforts

Given the general concept for risk management described above, presented below are some specific efforts currently under way at Hanford that illustrate the breadth of the risk management program. These efforts range from the drafting of Site policies on risk to the development of resource allocation techniques to the identification of specific applications of risk-based decision making.

Risk Policies

Risk analysts are currently working on developing several wide-ranging policies which deal with risk at the Hanford Site, as described below. Note that the development of the risk policies includes preparing the required directives and procedures, if the policies are to be implemented. Obviously, implementation will be possible only with the approval and support of DOE leadership, including DOE Headquarters.

Risk-Based Decision Making (RBDM). This policy will describe how RBDM will be conducted at Hanford as part of the systems engineering process. Guidelines will be published in the Systems Engineering Management Plan in June, 1994. This policy will present the reasons and philosophy underlying the need for RBDM, the process for conducting RBDM, and the organizational changes needed to implement RBDM at the Site level. It will identify those classes of decisions for which risk information will be considered. Guidance on how to weigh risk against other considerations, such as cost and schedule, will be developed. General guidance will be provided to risk assessment programs in terms of assumptions, data accuracy and formats, scenarios, and models to be employed in support of RBDM.

Public Involvement and Risk. This policy will provide recommendations to program and Site managers for involving the stakeholders (regulators, other government agencies, and public organizations) in risk-based decision making. It specifically will address public interests and values and the type and amount of information which will be provided to the public, information which will be obtained from the public, and the relationship with other public involvement activities. Public access to information and mechanisms for involving stakeholders will be addressed.

Risk Consistency at Program Levels. This policy will provide guidance to programs on how risk information (public and worker health, ecological, programmatic) can be used in assisting decision makers at various levels. It will provide common assumptions to be used at the program level and will strive for consistency in accuracy, methods, models, and interpretation of data. This policy will focus on consistency for risk information provided by programs for use in Site-level decisions; however, the guidelines could be applied to program-specific risk assessments and decisions, as well.

RBDM Relationship to NEPA and TPA. This policy will describe how RBDM at Hanford relates to the NEPA/CERCLA/RCRA decision processes. It will provide guidance for site and program managers on understanding and responding to regulatory authorities. The role of risk information in the NEPA process will be defined, and guidance will be provided for risk assessment and risk management activities in support of that process. Impacts of recent amendments to the Tri-Party Agreement on NEPA requirements for CERCLA activities will be identified.

Worker Health and Safety and Public Health Policy. This policy will state formally how the Site will view the potentially conflicting requirements of protecting the public and protecting the workers during remediation activities. If possible, this policy will formally compare worker risk to public risk and provide guidance to programs on requirements to identify each for any given project. Of particular interest is how much increase in worker risk is justified to achieve a potential reduction in public health risk from cleanup activities. The policy for trading worker and public health risk will require information on worker safety, both existing and that estimated for remediation activities during cleanup. The initial policy on this subject may be modified as more worker remediation data become available.

Site Residual Risk. This policy will state formally what risk to the public and the ecosystem is tolerable after cleanup is completed. The tolerable risk is naturally tied to end-state use and regulatory requirements, and determining that risk demands all regulatory requirements be identified for different areas, material balances, and potential uses of the land. Guidance to programs on their "share" of allocated risk will be developed. DOE legal liability will be addressed in subsequent policy developments. Since Site residual risk is dependent upon end-state public and ecological risk, the initial policy for this issue will require several assumptions about those risks and may have to be modified as end-state risk data estimates are improved.

Policy for Change Requests. This policy will explain how change requests will be evaluated based on risk information, among other things. It also will describe the risk information required to be submitted with change requests, especially programmatic risk, and the form and format of those data.

Risk versus Regulatory Requirements. A key issue facing decision makers is the degree to which the DOE will comply with regulatory requirements, especially when those requirements are overly restrictive, not cost-effective, or impractical. This policy will describe DOE's position on such matters and clarify those situations in which the DOE may need to seek exemptions or waivers from particular regulatory compliance requirements, or where indemnities against criminal sanctions may be needed. This complicated and potentially controversial policy will be dependent upon public and ecological end-state risk, as well as worker risk during remediation. For example, it may be the case that regulatory requirements mandate certain actions to reduce long-term ecological risk, but the DOE may choose to challenge such requirements, while arguing that worker risks or public health risks outweigh any potential benefits from remedial actions.

Risk-Based Resource Allocation

A special application of RBDM is the allocation of resources, especially funding, on the basis of risk and risk reduction. Risk analysts at Hanford are working on this special application of risk management. The problem, of course, is that in the past we have not generally allocated funding as a function of risk, except in an informal manner. For example, it may not be true (or it may be) that the programs with the greatest risk also have the greatest resources. The following example illustrates this point.

This year Hanford had $217M in unfunded requirements, ranging from activities which caused delay in Tri-Party Agreement milestones to those which protected workers in a given facility. In general, Hanford managers had no consistent, structured and repeatable procedure for deciding which of the unfunded requirements had the highest priority and which should be given marginal funding, should it become available.

In this regard, risk analysts have begun to survey different techniques used by DOE sites to prioritize their efforts. One such technique is the Priority Planning Grid (PPG), which has been available for use at Hanford and elsewhere for some time. Changes to the Priority Planning Grid have been made to ensure positive, as well as negative, aspects of an activity are considered. We may modify the PPG further, as appropriate, after completing our survey of priority planning techniques.

Hanford leaders are aware, of course, of DOE-HQ and Mr. Grumbly's emphasis on risk and consider our ability to demonstrate the link between funding and risk (and risk reduction) to be critical. An important consideration in such matters, of course, is the determination of risk data. With many different types of data, in different forms, from different risk generation processes, risk analysts and managers must be careful to ensure interpretation of the data is correct. For example, a total picture of risk for a specific land area may include potential health risk from an accidental release, damage to the groundwater from a discharge or leak into the ground, industrial accidents to workers as they decontaminate and demolish a radioactive facility, and potential ecological damage to wildlife. These risks often are not in the same form (say the increased chance of cancer deaths) and cannot be combined easily. If we add in economic, programmatic, and political risks, the picture becomes even less clear. Risk analysts at Hanford are working on this problem to help managers see the total situation from a risk perspective.

The policy implementing these procedures will require that all budget requests consider risk (as well as other things) and will address the requirement for risk information to be provided for all major budget allocation decisions.

Risk Applications to Major Hanford Decisions

As risk-based decision making is introduced at Hanford, managers have the opportunity to develop a structured process for addressing many of the major decisions they face. Risk analysts are currently working on issues surrounding the release of land and the question of "How clean is clean?" The DOE has announced that it intends to release about half of the Site for other uses this year. From a risk management perspective, there are important considerations to this decision, such as future liability of the DOE. Risk analysts are adapting EPA's comparative risk methodology and their risk assessment guidelines for Superfund to the land release decision. The intention is to broaden our implementation of risk-based decision making to the greater question of future land-use and land-release decisions.

A goal is to be able to address those decisions which have a Site-wide impact in a consistent, risk-based manner. This does not mean that decisions will be based on risk alone. Rather, that risk data will be available as an input to those decisions, so it can be considered along with other information. Another goal is to ensure these major decisions are identified early enough to provide all the information needed for decision makers, including the public. Without such foresight, the risk assessments necessary to support those decisions will not be completed in time.

Lessons Learned to Date

The Integrated Risk Assessment Program's initial research examined risks associated with a baseline, existing scenario that assumed the DOE walked away from the Site. We wanted to understand the risks associated with various activities under these assumptions and to understand better how much of our effort goes into protecting the public. We learned that the greatest potential risks involve the storage of cesium and strontium capsules and irradiated fuel. Without continued attention, these radioactive materials could cause considerable damage to the surrounding population. Similarly, special nuclear materials stored in other facilities could be released as a result of fires or other natural disasters. One lesson learned from examining risks in this manner is that a considerable portion of Hanford's budget goes for protection and maintenance activities--and not cleanup. Unless facilities are disposed of quickly, such activities will have to be continued for a long time. This reduces considerably the "discretionary" funding available to Site managers, and, frankly, those figures have not been analyzed to date.

Another lesson is the difficulty of identifying and clarify the decisions facing the Site. Our planning process, in general, has not called out these decisions, except within individual programs. Nailing down the decisions which have Site-wide impact, identifying the decision makers and the inputs to the decisions, and building a public involvement plan all have to be done if risk-based decision making is to be successful. This means, of course, that planners and managers must have a clear vision of where Hanford is going and the technical baseline that will get them there.

Conclusions

The Hanford decision-making process is characterized by decisions which do not adequately consider risk and are based primarily on compliance and stakeholder perceptions. The allocation of our resources is not based on an integrated risk management process, and the most urgent risks are not generally known. Our negotiators enter into discussions with regulators and the public without risk information at their fingertips and often cannot justify technical decisions from a risk perspective. Managers often do not take a Site-wide view.

Hanford leaders recognize that the decision process must be improved. There is a need to balance risk and other factors and allocate resources to reduce risk in a cost-effective manner. All decisions must take the global view, and negotiators must be armed with the knowledge of the risks associated with any alternative course of action. Finally, Hanford must have the ability to interact with stakeholders and include them in any risk-based approach to decision making.

To reach these goals, four things are necessary:

- Develop risk-based decision-making policies and procedures.
- Implement risk-based decision making through systems engineering and other activities.
- Develop health, safety, and ecological risk data to support Site-level decisions and DOE's mandate.
- Ensure all our customers are educated about the risks in a timely manner to support decision making

If we do all this, we will serve the taxpayers well, and we will continue to serve and protect the public.

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