The Risk Prioritization Process as it Shapes the Savannah River Site Integrated Priority List:

An Initial Review of the Savannah River Site Model

June 28, 2000

Charles W. Powers, Ph.D.
CRESP Executive Director

CONTRIBUTORS

Joanna Burger., Ph.D.
Serap Erdal Ph.D.
Barry R. Friedlander, M.D., M.P.H.
Michael Gochfeld, MD, Ph.D.
Bernard D. Goldstein, M.D.
Michael Greenberg, Ph.D.
David Kosson, Ph.D.
Lynn M. Waishwell, Ph.D., C.H.E.S.

CONSORTIUM FOR RISK EVALUATION WITH STAKEHOLDER PARTICIPATION - CRESP
317 George Street – Suite 202 – New Brunswick, New Jersey 08901
(732) 236-9603 FAX (732) 235-9607
www.cresp.org

ABSTRACT

At the request of DOE, CRESP reviewed the Risk Prioritization Process (RPP) used by the Savannah River Site (SRS) to shape the Integrated Priority List (IPL) which ranks SRS Environmental Management (EM) projects for budget purposes. This report constitutes the first phase of that review and focuses on: 1) the credibility, usefulness, effectiveness, and rationality of the way the RPP informs the IPL; 2) strengths and limitations of that process; and 3) initial recommendations for improvement. Briefly, the RPP employs a complex Risk Value Matrix (RVM) that evaluates SRS work packages, using nine individually-weighted criteria that are integrated into a two-dimensional geometric-scale scoring system. The nine criteria are Public Health and Safety, Environmental Protection, Worker Health and Safety, Compliance with Standards, Cleanup Mission/Business Efficiency, Safeguards and Security, Public and Community Relations, Cost Effectiveness, and Mission Viability. The scores generated by the RVM evaluations are combined with further considerations of efficiency and management judgement and yield an IPL whose rankings then establish the final funding priorities for the EM budget at the Site. CRESP's initial independent review yields four key initial findings:

1) The current system, shaped with impressive public involvement, should be retained and incrementally improved until an effective alternative is devised, as it provides useful information about the impact of one-year delays in the implementation of EM activities. The limited scope of what the current system actually measures should be made more explicit to all that use or are provided access to it.

2) The use of one-year delays in the implementation of EM-activities as a decision-making benchmark is not adequate. Metrics should be designed to measure the longer time frames that EM problems pose and require cleanup activities. And year-to-year progress tracking in risk reduction is needed to properly support the management of multi-year projects.

3) DOE-SRS should devote significant effort to develop a prioritization process of larger scope. We suggest that it evaluate how the current and anticipated risks posed by an EM problem should be combined with efficiency factors to shape the timing and priority given to implementing activities that not only contain but also solve the problem.

4) The specific metrics used for each of the RVM criteria need to be reviewed and improved. They currently affect the RVM scores and rankings aberrantly. Environmental and chronic human health risks are not adequately reflected in the RVM.

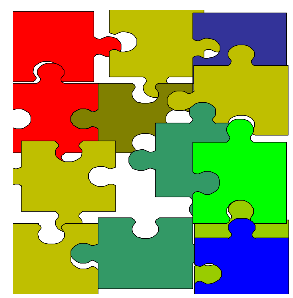
The Risk Prioritization Process as it Shapes the Savannah River Site Integrated Priority List: An Initial Review of the Savannah River Site Model

TABLE OF CONTENTS

EXECUTIVE SUMMARY

At the request of the Manager of the Savannah River Site (SRS), and with the active support of the Office of Environmental Management (EM) at Department of Energy (DOE) headquarters, the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) has conducted an initial independent review of the process used by the Savannah River Site for prioritizing projects and work packages since 1995.[1] We understand that the factors which occasioned this request relate to the Department's own review of the priority being given to specific SRS projects which are of particular concern to the Defense Nuclear Facilities Safety Board (DFNSB). But the scope of the CRESP review being undertaken here does not include any specific consideration of those issues. And the timing of this CRESP review is, in any event, not tied to the Department's decisions related to these DNFSB concerns in the 2001 budget. Safeguards and Security are of critical national and international importance but are not in the domain of this review.

Figure 1: *The **SRS Risk Prioritization Process*** depicted as puzzle pieces that, when the key assumptions are accepted, nearly fit together to comprise a complete prioritization picture. We find the actual puzzle to require somewhat different solutions. See also Figure 2, p. 10 and Figures 2-9 where the pieces are defined.



Instead, CRESP seeks in this initial review to describe, evaluate and to make preliminary recommendations concerning the complex process used by SRS both to decide how to rank its EM work and how to explain those selections to DOE's stakeholders and many publics.

The procedure used is called the ***SRS Risk Prioritization Process (RPP)*** and is composed of several elements whose connections are described later in the report. There are fundamentally two parts of this SRS process. First, ***The Risk Value Matrix (RVM)*** incorporates nine separate, weighted criteria that are used to evaluate quantitatively the importance of all defined SRS projects or work packages. Second, the ***Integrated Priority List (IPL)*** utilizes the RVM and other factors to achieve the rank ordering of all of the SRS projects for funding purposes. Since funding is not available to support all proposed Site projects in any given budget cycle, this IPL list clarifies what will and will not be funded. The pieces actually fit together quite well and can be legitimately pictured as a completed puzzle when the various assumptions underlying the RPP are granted (Figure 1), though the report will highlight our findings that the complete puzzle sometimes obscures important problems.

[1] In order to improve this review product, the initial draft of CRESP's evaluation of the SRS Risk Prioritization Process has undergone a review by the CRESP Peer Review Committee. This Committee, created to be independent of CRESP's operational processes, reviews key CRESP reports and has been involved periodically in the review of DOE's efforts to include risk in DOE decision making since 1996. This report was modified to address the concerns raised by the CRESP Peer Review Committee, and the Committee's comments are appended to the final version of this report.

The results of this initial CRESP inquiry are the following. CRESP finds the SRS Risk Prioritization Process to be made up of many pieces of a coherent process that has been used with consistency for five years. Because the evaluation of the Site activities is conducted and separately reviewed by involved Site experts, the project-by-project evaluations have presumptive technical merit.[2] And because those individual judgments are converted into quantitative evaluations in accordance with commonly-defined criteria, they are mostly transparent, and the potential exists for effective outside review of most key elements of those judgments. Further, as the Site's RPP was being developed, key elements of it were both defined and "weighted" in dialogue with the public, and both the process and its results are annually explained to and vetted with the public. Hence, this budgeting system may be unique in its effective inclusion of interested publics in the exceedingly complicated task of ranking the Site's EM work.[3]

CRESP strongly recommends that the Site **continue to use this RPP process with modest changes** (discussed below) unless or until another fully tested process has been adopted. It does capture **key elements needed to prioritize risks** (both receptor and managerial) at the Site. It is now used by Site managers and the Site's stakeholders that have been involved and they have at least some familiarity with it. Judgments about the near-term effects of project delay have been modified over time. A Site manager or a member of the public can, in principle, track those judgments and pursue the logic of Site decisions on specific projects for the five years the process has been in existence.[4] It is commendable that the Site has achieved this coherence and consistency in using and applying risk criteria to prioritize its activities while functioning in a national context where DOE-EM's own risk processes have been in flux and lack comparable coherence (CRESP, 1999). Finally, SRS RPP does provide a system for using risk to evaluate whether the activities at the Site adequately assure short-term minimum-safe conditions for all currently defined environmental management activities.

But can the SRS RPP adequately define and evaluate the evolution of the risk-creating problems that both generate EM action and then track and finally forecast these risk challenges as they evolve in multiple-year projects toward defined completion goals? Can the process shed any light on when project speed up or slow down would be a prudent choice, or when alternative ways of achieving the same goal could best be considered, so as to enhance overall project effectiveness? It should do so in order to provide DOE managers and the Site's publics with risk information organized in ways that allow them effectively to alter, rearrange, reorder and thus evaluate and manage the diverse kinds of risks posed by the diverse contaminated materials in many complex media that are found at SRS. Such managerial considerations are inevitable in the face of resource constraints and unanticipated difficulties likely to be encountered in implementing any EM program of this scope. Also RPP should be linked to the full life-cycle descriptions of how current activities address the envisaged solutions to defined EM problems, show how the program accounts for the interdependencies of those activities, and is tied to economic efficiency. Unless risk data of this sort are organized and available to inform EM decisions, real risk-informed decision making is likely to

2 Although the judgments may not be disinterested. See page 13 where the tendency for resident experts to preserve a known program is discussed.

3 This is no small feat: there are apparently more than 200 environmental problems which are linked to selected activities whose total costs exceed $1.5 billion per year.

4 However, the elements of the current system do not appear to be linked in ways that allow ready review of what judgments were made about risks of specific projects and why.

be fragmented and infeasible.

When the current SRS RPP is tested against these objectives, we find the current process is importantly incomplete. Indeed, the valued coherence of the process could even be misleading to an unwary public or manager who might expect the process to in fact be answering questions about the longer-term risks at the Site and about the prognosis for risk reduction that the RPP never asked.

Some of these deficiencies can be quickly and effectively remedied. For example, the diverse elements of the process[5] should be better linked graphically and tied together into a coherent system whose parts are effectively described to its users. We doubt that the actual coherence of the pieces of the process are understood by many SRS managers and are quite sure they cannot be readily comprehended *as a system* by SRS' many publics, including even those to whom SRS reports at DOE. Despite its limitations, there is important information to be gleaned from the RPP that we doubt decision-makers can currently use effectively. Although we make a preliminary attempt to describe this system in Section I, its improved articulation by those who manage and create pieces of the system is a near-term imperative. Those who devised this system (including the participating publics) are not reaping the full benefit of their substantial achievement. In addition, there are multiple ways in which specific parts or elements of the existing process could and should be improved and made more internally consistent. We discuss these in Section IV of this report.

Needed improvements in the system go beyond better articulation, display and refinement. The current system is incomplete. This may well flow from a single assumption that determines the shape and scope of the current RPP. The entire RPP is designed to provide an evaluation of what are the risks that something of measured consequence might "happen" in a definable scenario if the project or activity designed to address that situation is not funded ***for one year***. That is, the entire RPP is constructed to answer a single question: what if we do not do ***this project, in this way, this year*****? It reflects the risk of not doing an activity, rather than the risk reduction that will be accomplished by successful completion of the activity.** Since the risk of "not doing the activity" is the only metric the SRS Process is designed to assess, it is likely the only one which it currently can be expected reliably to address.

Certainly, any good risk prioritization system used in yearly budgeting should provide an answer to the consequence of a single year's delay in funded and unfunded projects. However, a singular focus effectively disconnects the evaluation of risk – **both** risks to receptors and programmatic risks -- from virtually all of the real challenges of prioritizing and managing the multiple-year projects that characterize the EM program at SRS.[6] Further, the time frame for risk evaluation separates and

5 We should note that several of the CRESP contributors to this review have had some knowledge of the evolution of the SRS RPP process since its inception, and some CRESP contributors received excellent briefings from those who devised and operate and use the system in preparation for this review. Nevertheless, CRESP personnel have found the process of actually understanding what the RPP does and does not address to be slow and arduous. Several of these CRESP participants are national experts in evaluating risk ranking systems for environmental activities and yet have struggled to interpret what would appear to be simple components of this system.

6 This statement should not be over-interpreted. Risk information is used to play key roles in a variety of other decision making contexts at SRS. Risk is cited in the articulation and evaluation of alternatives considered in the development of most compliance activities. It is used in highly sophisticated ways in engineering safety

makes nearly incomparable the results of the RPP with the several types of risk evaluation that are part of the diverse regulatory programs that set compliance requirements for the Site. None of these regulatory approaches make a one-year time frame key to any of their evaluations.[7] And, finally, by specifying such a short time frame, the RPP increasingly separates the evaluation of risk done systematically at the Site from the recent and evolving EM system which seeks to manage the EM program through a focus on project completion and long-term stewardship. In sum, the very factors that make the RPP system so robust in evaluating the short-term risks of *activity discontinuity* on meeting minimum safety requirements[8] simultaneously renders it dysfunctional for the accurate evaluation of risks *in other essential time frames,* and for other key purposes (e.g., such as how to judge whether less expensive alternatives could be used to bridge a one-year delay or, indeed, to address the stated problem in any fundamentally different way).

Three significant changes would need to be introduced into the SRS process to make it responsive to these concerns.

- First, a revised/reformed process would need to define a ***problem*** baseline, link it to an activity and incorporate an evaluation of: 1) risks associated with the activity itself during and after the life of the project instead of only focusing on one-year delays and 2) the target risk reduction for ***the problem*** at different assessment points over the entire project cycle.[9]
- Second, the process would have to include a method for ongoing tracking of "progress" made in respect of the evaluated risks and to incorporate lessons learned from this tracking effort.
- And finally, the SRS process would need to incorporate[10] alternative activities and approaches to address the problem with at least some exposition of what steps could be taken to address the problem if cost-cutting or delays slowed the activity or if technology specified in the currently-preferred activity failed to achieve its goals.

CRESP recognizes that the changes proposed here and throughout the report which follows represent very significant changes for the SRS RPP process. They would need to be developed with the same care and public involvement efforts as was the original RPP. The suggested changes would add to the complexity of the evaluation of risk ranking at the Site, and it is not something that can be done within one month nor can it be expected to be free of further alteration in the future.

In CRESP's discussions with both SRS and DOE-EM leadership in March 2000, the prospect of

---

calculations, etc. And, as was highlighted by the CRESP Peer Review Committee's recent Peer Review of the U.S. Department of Energy's Use of Risk in its Prioritization Process (CRESP, 1999), the way in which risk is calculated differs among the many regulatory programs to which the DOE-EM efforts are responsible. Rather the point here is that the very narrow frame of what the risk ranking and prioritization process (RPP) records as it organizes these risk-related and risk-based processes in order to rank them fails to incorporate or effectively link the information generated except as it informs whether not doing something for a year would be "risky" and if so, how risky.

7 This characteristic may well partly, though surely not wholly, explain the disconnect between the RVM's findings for public, worker and environmental protection and those for the consequence of meeting compliance standards.

8 This is what the Site calls Risk Containment in the materials describing its RPP (see p. 5 of the SRS Environmental Management Program Prioritization Process prepared for CRESP, March 2000)

9 This is true whether or not additional stewardship care or monitoring requirements are expected.

10 Either directly as part of the RPP itself or as part of a data base to which it was systematically linked.

CRESP conducting a two-phase review was discussed. This report represents Phase 1. Were there to be a Phase 2, it could test a significant sample of the current IPL projects and the RVM evaluations that underlie them. Such a review would clarify and validate whether the current system is being used consistently by SRS personnel in the several EM program areas. Hence it could assess the extent to which the current RPP can be used to justify actual rankings when specific parts of the IPL are under challenge from one or another advisory group, regulator or other stakeholder. But perhaps more important, this follow-on, Phase 2 review would also provide a window into whether the existing system could be directly revised to accommodate the deficiencies in the current RPP just discussed. After discussing this report with EM and SRS and other stakeholders, CRESP will determine whether to devise a specific scope for such a Phase II follow-up study.

CRESP REPORT

Introduction

During the final week of February, 2000, CRESP leadership was contacted by Mr. Greg Rudy, Manager of the Savannah River Site (SRS), to determine the organization's interest and availability to conduct an initial independent review of the process used for prioritizing projects and work packages used since 1995 by the Savannah River Site. CRESP determined that the Office of Environmental Management at DOE actively supported such a review. Several CRESP personnel met with a group of SRS personnel on February 28 to review materials relevant to the RPP. After discussions with the full leadership, CRESP determined that it should conduct a short-term review of the RPP process itself and then determine whether a more substantial study could be of value. CRESP determined that its own short review would be conducted by its researchers and operations personnel and then be reviewed by CRESP's independent Peer Review Committee. On March 7, a four-person CRESP team, including representatives of both its operations and peer review functions, traveled to SRS to observe a DOE briefing for senior Headquarters and SRS officials on budget and risk issues that were of particular concern to the DNFSB but that included general discussion of the RPP and its applications.

This report, then, is primarily a study of a process and not results. CRESP is aware that the factors which occasioned the request from DOE units were prompted by the Department's own review of the priority being given to specific SRS projects which are of particular concern to the Defense Nuclear Facilities Safety Board (DNFSB). The Department's decisions related to these DNFSB concerns for the 2001 budget were apparently resolved during the time that this study was being done. Although the results of this and any additional study might be tailored to address those DNFSB-related ranking issues for future budgets, there was agreement as to the scope of this study between CRESP and senior SRS personnel and highlighted by John Pescosolido (CFO-SRS, DOE) on March 7, 2000. It was understood that CRESP's assessment would:

- Review the IPL process, the results it produces and its assessment of activities to determine if it is a credible and useful method to rank risks, a method that has provided rational results;
- Describe limitations of the process;
- Provide advice on how the process might be improved; and
- Suggest methods to address non-discretionary expenditures and/or mandates in the context of IPL.

What is and is not the focus of this CRESP assessment? The report concentrates on the RVM and particularly its application to score the RVM criteria on receptor risks. These are primarily the public health and safety, environmental protection, worker health and safety criteria (and also the safeguards and security criterion). We note that the public and community relations criterion in the SRS RPP no longer measures social and economic impacts of EM activities, although it did do so in an early formulation. The report also provides general observations regarding the RVM as an evaluative tool. It does not specifically review the RVM's definition and ranking process for business risk categories except as they inform the way in which the RPP incorporates them into overall risk rankings. Furthermore, the report's review of the adequacy by which compliance requirements are assessed, interpreted, and negotiated with regulators is modest.

The CRESP Effort and Use of External Evaluative Criteria.

This assessment of the entire RPP process has demonstrably been performed independently of and external to the Department of Energy. It offers recommendations with the intent to improve information gathering, dissemination and program performance. A substantial amount of data, information and both professional and managerial experience has been accrued by CRESP personnel at the Site. The CRESP personnel working on this report have had both practical and academic experience in program evaluation and have a working understanding of SRS functions and challenges. Still, because this review is limited to an examination of method, the resource base for our evaluation was largely restricted to relevant, publicly available reports and Site documents. CRESP personnel have, during the five years the RPP has been operating, observed advisory and other public meetings concerning RPP, and have even participated in discussions about, both the components and implementation of the RPP. But users of and stakeholders in the system were not interviewed during this study.

Section I. The Risk Prioritization Process, Risk Value Matrix and Integrated Priority List

In this section we describe the SRS Risk Prioritization Process, which includes and is the foundation of the Integrated Priority List (IPL). The IPL lists some nearly 200 projects or work packages and is used by the Site to explain and even defend its decisions as to which to fund. Figure 2 lists the components of the RPP as CRESP understands them.

Figure 2: The basic elements of the Savannah River Site Risk Prioritization Process as synthesized from the materials provided to CRESP by the Site. For the Site's own description of this process, see Attachment A.

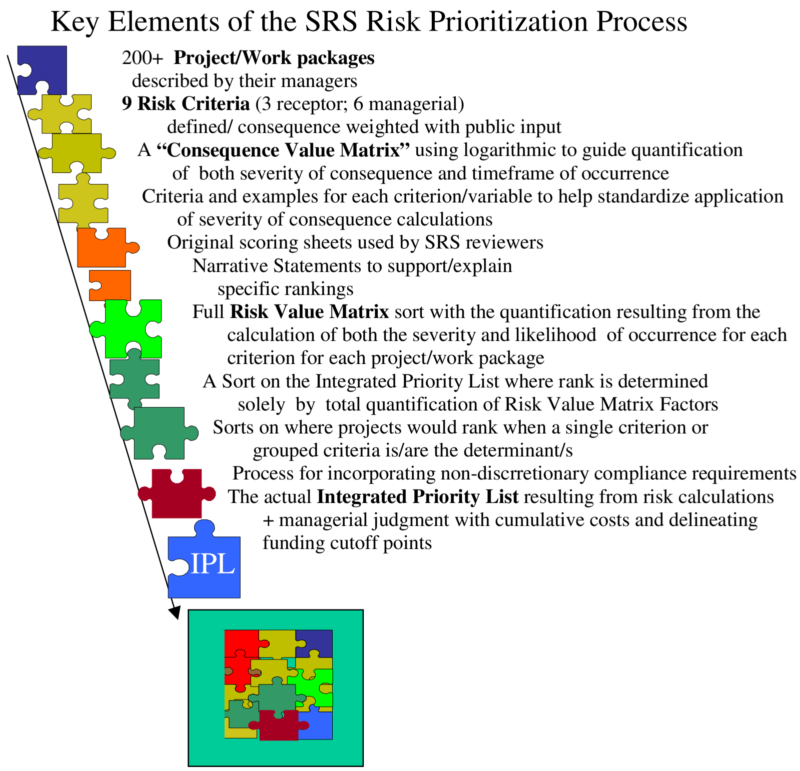
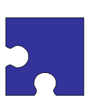


Figure 3: First Key Element of the RPP –



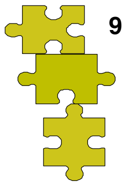
The eleven elements depicted in Figure 2 fit together to create a quite cohesive system. The base of the system is the work packages that first describe an activity and then describe a problem that the activity is designed to address (Figure 3). These activities differ in size, scope and duration. Some address problems by trying temporarily to contain contaminant releases, where the goal of the activity is simply to maintain a minimum safe status; others seek to ameliorate the problem or reduce the risk. These differences create evaluative problems for the RPP largely because the only issue to which the entire evaluation is directed is how the risks will be affected or will vary if the activity as described is not performed for a one-year period. There are more activities than funds to address them. And in some cases there are more activities than there are problems because different activities are actually intended to address the same problem in different ways. For example, some activities are meant to simply contain (that is, maintain current risk protection) and some are aimed at actually reducing the risks and solving the problem. The process by which a specific activity emerges as the one that will be used to address a problem is simply not transparent in this system and is likely to be quite different in the many different regulatory selection processes under which the Site operates. It is similarly not clear how these activities, which do vary over time (as when activities are redefined, completed and the like) evolve in and out of the system. On the basis of the information CRESP was given, we conclude that this disparity or lack of a connection is caused in part by the fact that the evaluation provided by the RPP is apparently not well integrated with, and is not intended to be well integrated with, the project completion process at the Site (see below).

Comment: This decision to make ***activities*** *the subjects of RPP evaluation has enormous consequences for the entire RPP system. First, because it is the activity which defines the work package, the* ***problem*** *being addressed by the activity is derivatively defined – i.e. the "problem" is seen through the prism of what the activity is doing about the problem: Activity"y" will contain" x" and thus prevent the release of contaminant "x"; failure to implement this activity for one year will …. (see below). Obviously an extended process (likely involving regulators and others) has occurred by the time the activity becomes a work package. And we assume that there has typically been a robust process of deciding how to define the problem and what might best be done about it. But this RPP process of problem definition is not linked to the work package, nor is there anything about the RPP which considers alternatives. As an example, the environmental restoration program at SRS is being transformed by a new regulatory approach, the Integrator Operable Unit (IOU), whose beginning point is an analysis of an entire area of the Site rather than one or more specific release points. The "problem" in those areas is being entirely redefined and it is expected that the "activities" that will be defined and prioritized under the IOU will reshape the definition and priority of activities that were originally defined at the operable units which were located by contaminant sources. The current IPL designates activities that reflect the beginnings of the IOU transformation, in that ER activities are now listed by watershed area. But the learning that is being developed in the IOU process about the area-wide* ***problem*** *that ER activity must address is very poorly indicated by the citation of three types of ER activity in the area*[11] *The significance of properly defining the "subject" of evaluation will emerge throughout this report.*[12]

11 S&M, Assessment and Remediation

12 This same issue of properly defining **what** it is that is being evaluated was of great concern to the CRESP Peer Review Committee in 1996 when it reviewed the emerging Management Evaluation Process (MEP) then being used across the EM complex. (See <u>Peer Review of the FY 1998 Budget Formulation Process of the U. S. Department of Energy Office of Environmental Management</u>, Peer Review Committee of the Consortium for Risk Evaluation with Stakeholder Participation [CRESP] July 31, 1996, p.4). Indeed the Committee's very first topic in the Report was to question whether DOE was correct to use an activity rather than a problem or an objective as the subject of evaluation and prioritization. Although the terms used in 1996 were slightly different, the Committee's very first concern about the EM system was the following: "[b]y often making Risk Data Sheets (RDS's) subordinate to ADS's [Activity Data Sheets] and thereby, focusing risk evaluation on activities rather than objectives, the MEP has tended to obscure the relative importance of the primary purposes in question and to

Figure 3A – Second Key Element of the RPP



9 Risk Criteria (3 receptor; 6 managerial)
defined/ consequence weighted with public input

A **"Consequence Value Matrix"** using logarithmic scale to guide quantification of both severity of consequence and time frame of occurrence

Criteria and examples for each criterion/variable to help standardize applicatio of severity of consequence calculations

The heart of the actual SRS Risk Prioritization Process is the makeup and definition of *attributes* of the individual work packages that are evaluated and which are used as criteria to establish each package's relative importance among the EM work performed by the Site (Figure 3A). Each work package is subject to the same multi-step evaluation, i.e. to the evaluation of the significance of the activity when evaluated by each of 9[13] criteria. The RPP uses the following broad attributes; the number in the parenthesis that follows each criterion is the weight, which could range from 0.00 to 1.0.

The process for selecting these criteria is a distinctive part of the SRS RPP. When these criteria were chosen in November and December of 1995, they represented an effort by the Site and its publics to select a distinctive list of attributes for SRS that were similar to, but not identical with, the evaluation attributes being used in the national EM program. The Management Evaluation Plan being used by the national EM program at the time listed only seven criteria. In a series of three special-purpose meetings, sponsored by the Site's Citizen's Advisory Board (SRS CAB 1995a, 1995b, 1995c), the involved Site personnel and various publics not only redefined the criteria by which EM activities at SRS would be evaluated, but then rated the relative importance of the criteria. They added two criteria [Mission Viability and Safeguards and Security] to the seven on the national list. And they redefined others. For example, the category defined by the national EM program as Social, Economic and Cultural Impact evolved into the current Public and Community Relations criterion[14]. The term Mortgage Reduction that was originally included in the national EM program was linked with Cost Effectiveness; at SRS the term Mortgage Reduction, was dropped (leaving only Cost Effectiveness). Finally, the term used in the national EM program, was Mission Impact and was transformed by the Site into Cleanup Mission/Business Efficiency, although this

---

preclude consideration of alternative solutions. Furthermore, because the MEP has been largely activity-oriented, rather than objective-oriented, it has tended to evaluate the effectiveness of a given activity over too short a time horizon (i.e., a single budget year), rather than over the lifetime of the project in question." This issue of what it is that is being evaluated has confused EM risk prioritization and the effects are seen also in the SRS RPP.

13 It should be noted that the Site has never actually individually ranked one of the criteria, Mission Viability. Instead senior management incorporates consideration of this issue into its more general process of allowing those managerial judgments to shape the IPL ranking after all of the other factors have been measured and addressed.

14 In fact, this change occurred over time and in several steps. Initially, the participants at the CAB's meetings sought to capture both the actual impact of the possible delay of the activity and to assess how that impact would affect the public reaction to the Site. As the effort to agree on metrics for social and economic impact foundered, the idea took hold that the effect of these impacts would be adequately reflected by the intensity of public reaction. Hence, the decision to drop Social, Economic and Cultural Impact and to replace the criterion with one called Community and Public Relations was a natural evolution from the problems inherent in measuring both impact and managerial reaction. It leaves the criterion measuring, however, only factors of consequence for the management of the site, not consequences for the community.

change appears to have occurred sometime after the 1995 public discussion and comment. The minutes from the meetings at which these criteria were selected indicate that the participants believed they were defining criteria in ways that were coherent with local values. For example, Safeguards and Security was thought to deserve its own criterion because of the specific legacy waste and structures remaining at the Site.[15]

The public meetings that first selected the criteria then evolved into what may have been a unique enterprise in the DOE complex. The process of ranking the criteria themselves, in terms of their relative importance on a scale of 1 (.00 to 1.0), is distinctive. The entire naming and ranking process was taken particularly seriously by the public. (The numbers found to the right of the column of criteria in Figure 4 show those weights.) Further, still working in the public contexts, the Site personnel took the Site weightings and developed a complete consequence matrix which, again, was similar to but not identical to the one developed nationally. In this consequence value matrix logarithmic scales were used to provide quantification for the two factors which combined to create the quantification: first on the vertical axis is a graded set of example consequences from least to most severe, <u>specific to each criterion</u> and ready to be applied to evaluate each of the work packages; second, on the horizontal axis, is a likelihood of occurrence grading that goes from very high to low (see Figure 5 and for the full matrix, see Attachment B). Of significance is the fact that this grading is to be universally applied to each work package and uses as its sole determinant whether the consequence of concern is expected to occur in one year or will occur in 1-10, 10-100 or 100-1000 years. A higher score is assigned to categories with greater severity of consequence and with greater likelihood of occurrence, as noted in Figure 5. A score of 3000 is given for a fatality event likely to occur within one year, where only 3 points if in 100 years. The consequence tables for Public Health and Safety are tailored to reflect the severity of events that might occur in respect of public exposure. But in the RPP, the metric for likelihood is not a percentile *likelihood* of occurrence. Instead, (as is often done in safety calculations of very unlikely events) the measure is the time frame within which the specific adverse consequence might be expected to occur. Finally, the Risk Value Matrix that provides the template for quantitatively measuring the combined severity and likelihood of consequence is augmented by a package of example "consequence scenarios" which provide those charged with evaluating each work package with a common set of examples for determining how severe or likely the adverse event would be if it were to occur (See Attachment C). Hence, the combination of the criteria with the risk value matrix supplemented with examples provides the

Figure 4: The 9 Risk Value Matrix Criteria as ranked by citizens at the Site, 1995:

Criterion	*Weight 0-1.*
▪ Public Health and Safety	(1.00)
▪ Environmental Protection	(0.85)
▪ Worker Health and Safety	(0.90)
▪ Compliance with Standards	(0.60)
▪ Cleanup Mission/Business Efficiency	(0.55)
▪ Safeguards and Security	(1.00)
▪ Public and Community Relations	(0.40)
▪ Cost Effectiveness	(0.65)
▪ Mission Viability	(0.70)

15 Discussion of whether the security issues are best related to the EM functions or to Defense Products continues. But as noted in Footnote 23 to this Report, the current system submerges the importance of this category in the RPP decision-making scheme. CRESP would examine this category more completely in a Phase II of this study.

"grader" with a consistent guide on to how to conduct the ranking of the individual work packages.

Figure 5

Example RVM Matrix for 1 of the 9 Criteria

Consequences: A. Public Health & Safety	Likelihood of Occurrence: Very High (Years 1)	High (1-10)	Medium (10-100)	Low (100-1000)
A1 Release above Normal Limits.	o 10.	o 1.	o 0.1	o 0.01
A2 Release Greater than Allowable	o 70.	o 7.	o 0.7	o 0.07
A3 Minor Injury, Exposure>0.1 Rem	o 550.	o 55.	o 5.5	o 0.55
A4 Exposure >0.5 Rem .	o 790.	o 79.	o 7.9	o 0.79
A5 Major Injury, Exposure>25 Rem	o1880.	o 188.	o 18.8	o 1.88
A6 Single Fatality, Exposure>LD50	o 3000.	o 300.	o 30.	o 3.
A7 Multiple Fatalities,Exposure>LD50	o no values defined			

Commentary: Section IV reviews in detail the severity metrics by which the criteria were weighted and scored; we also review whether the example scenarios provide good guidance for thinking through the applicability and significance of what would happen if a work package were delayed in funding for a year. The legitimacy of the criteria as scored in the Consequence Value Matrix, which allows the criteria to be quantitatively applied, derives primarily from the fact that it was created in a consensus process that was then ratified by the Site's official federal advisory board. Whether a similar exercise would yield the same rankings and even the same matrix five years later could be answered only by conducting another ranking process.

Figure 6 Third Key Element of the RPP

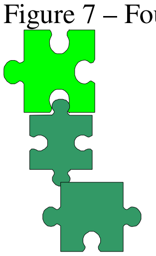
Original scoring sheets used by SRS reviewers and Narrative Statements to support/explain specific rankings

Using the Risk Value Matrix (RVM) and the examples that are to guide its use, Site personnel most familiar with the project then apply the ranking system to each of the work packages. These ranking, which are a very transparent part of the RPP process, are typically explained in the narratives that accompany the scoring sheets. It is in those explanations that insight into how the "graders" do or do not differentiate the problem being addressed by the activity *from* the activity itself can be seen. The Site regularly then seeks a peer review of these rankings by other personnel who are familiar with the activity and its objective but not directly involved with it.

Commentary: A common problem with any ranking system seeking to assess highly technical problems or activities is that those who know enough to evaluate the specifics of a project may not have broad perspective about the relative importance of the project they know well. And the *tendency to preserve earlier or previous rankings in order to expedite a known program is always a factor for those directly involved. That is why a second look is always preferable. The internal SRS peer review process very briefly described by the Site to CRESP has not been rigorously reviewed in this report. Nevertheless, the fact that the rankings are so available for inspection does provide transparency and invites outside evaluation. But there is another issue as well: is it possible to rank risk consequences accurately using this process? We are not sure. Even the most knowledgeable expert may not realistically be able to assess the significance of a one-year's delay in a major multi-year project if the issue is how such a delay might add to the likelihood of a graded consequence occurring. Why? For example, the metric for likelihood is not a per cent chance of the event occurring. Instead it involves a projection of when the adverse event might occur, and the task for the grader is, then, daunting. The task is to calculate over a 1000- year period what a one-year's delay in conducting the activity would mean for the likely occurrence of an event. Four options are to be evaluated; that it occur in the first year, in the first to tenth year, in the tenth year to year one hundred, and in the years from one hundred to one thousand. As we noted, such calculations are being done for each of the eight scored criteria. Forecasts made in this way do not have a solid intellectual basis and are likely to be prone to substantial variability and potential error.*

Once the individual rankings have been done, the RPP task becomes how to use those rankings to best inform decision making to yield a ranking of all of the work packages to provide the optimal Site work scope – i.e. that will eventually be captured by the Integrated Priority List (IPL).

Figure 7 – Fourth Key Element of the RPP



Full **Risk Value Matrix** sort with the quantification resulting from the calculation of both the severity and likelihood of occurrence for each criterion for each project/work package

A Sort on the Integrated Priority List where rank is determined solely by total quantification of Risk Value Matrix Factors

Sorts on where projects would rank when a single criterion or grouped criteria is/are the determinant/s

The material provided to CRESP for its evaluation of the RPP provides a very interesting window on this process. As Figure 7 indicates, CRESP was given for the purposes of this report a series of data sheets with rankings or "sort runs," that capture the quantitative evaluations of each of the projects evaluated by each of eight of the nine criteria[16]. In some cases these runs carry an annual budget figure for each activity and a running total of all expenditures in the list. We were given the total set of all scores resulting from all of the Risk Value Matrix calculations for all of the 129 activities which the Site had forecasted it could fund for the next fiscal year and an additional set of evaluated projects that did not make the cut. If the Site were simply to "apply" the results of its complex Risk Value Matrix quantification process to create the IPL, then the sum of all of the scored criteria for each of the work packages would give rise to a simple ranking of work packages listed, beginning with the highest RVM total number. [17] The Site apparently recognizes that the lumped criteria really represent the ranking of "apples, oranges and pears." The scores

16 The category Mission Viability is not formally scored as are the other criteria but instead is used in the managerial decision about the relationship of the specific work package to the overall work of the Site. (Source: Mary Flora of WSRC-SRS).

17 We discuss anomalies in this system later.

generated by summing up the ranking of all 8 criteria are not likely to provide a manager with what he/she wants to know.

We have not earlier drawn attention to the fact that when an activity is ranked for its impact on safety (impact on one or other receptor – public, worker, environment or security) then the ranking is based on the severity of a possible scenario caused by *the problem* which the activity is designed to address. The score is an estimate of the severity of the event the *problem* would create (in one or other time frame) if the activity to solve the problem or to prevent the problem from generating injury is not carried out in a timely way. But when the criterion of concern is a managerial or programmatic risk (for example, cost-effectiveness or cleanup mission), the scenarios evaluated are not related to the problem but to the impacts that would occur for the *activity* itself. So, for example, a one-year funding delay could cause disruptions related to scheduling and human resource management and efficiencies of the project and its managers. For the four "managerial risk" criteria in the RPP, it is not a risk to receptors but a programmatic or business risk that is given a score. The RVM simply adds up the public, worker and environmental risk numbers and lumps them with the business efficiency ones. Hence, it is unclear whether a manager contemplating a decision about whether to include or not to include the work package in next year's work scope will really be helped in any way by knowing the total RVM number. That is why it is useful to have the "sorts" that score whether the problem will cause a major public or worker health threat if this year's funding is delayed. Similarly, it is useful to have the sorts that help the decision-maker understand how severe the consequence is of not meeting compliance standards or efficiency goals. We have included an example of these sorts in Attachment D as there is no simple way of summarizing them.

Commentary: The ability to review carefully what the ranked list of projects would look like if the sort were based on each single criterion or on scores from clusters of criteria, allows the manager to sweep across a wide swath of Site activities and determine how the emerging IPL stacks up when the criterion is of particular concern. There is rapid learning gained cumulatively, when the Site's work is examined from eight different focal points. Assuming that the individual score totals are credible, the RPP's scores can, when brought forward into a Site-wide sort, provide a powerful tool for both broad evaluation and for keeping focus on specific issues. For example, if the IPL ranks a set of four or five projects just below the funding level because they score poorly on the cost-effectiveness scale, but the worker risk rankings are very high, that fact can be gleaned by the manager or observer with a focus on worker health. For the manager or the member of the public willing to use these sorts, they can be exceedingly valuable. If, however, there are major discrepancies in how work packages are evaluated and /or if the ranking shows a systematic bias, then precisely the power of these Site-wide sorts makes them extremely potent sources of distortion. As we will see in Section II, the system's coherence runs up against its weaknesses most powerfully at this point. It has been of great help to CRESP in developing this report to scan the different "sorts" to see how dramatically the ordering of the IPL is shaped and reshaped when different criteria are used or emphasized.

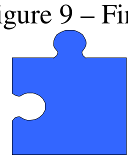
The RPP does examine the criteria of Compliance with Standards as one of the eight-scored criteria. But it is clear that in the ultimate decision-making, projects that are required by compliance requirements achieve a special status. We will return to this issue in both Section II and Section III. Here we focus on the limited issue raised in Figure 8, i.e. on the way the RPP itself internally addresses the issue of compliance. We note that this Compliance with Standards criterion caused considerable public discussion when the criteria and the weights were first assigned in 1995. It was originally argued by the public meeting participants that there should simply be no discrepancy between the calculations of public, worker, and environmental risks and the compliance with standards criterion. Weren't [Shouldn't] compliance activities [be] designed to focus on the relative risk? Some participants argued that as a matter of principle there should be no scored compliance category, as it would be duplicative to rank both compliance and the receptor risk categories. It was for this reason that the consequences for the criterion itself was specifically designed to measure only how severe would be the enforcement impact on management should the Site not meet compliance obligations. And with such a definition in place, the participants involved ranked Compliance with Standards quite low (7th among the 9 criteria). Again, the focus of this criterion is not on what risk would be created by not addressing the problem, but what risks the management would incur if their activity failed to meet the compliance requirements. Nevertheless, as we will see, a major determinant of the final IPL developed by the Site is whether the to-be-funded activities meet the compliance requirements set in the Federal Facilities Agreement (FFA) between the Department, the State of South Carolina and the EPA. But the Department's own compliance requirements and obligations set by other regulators are also scored in this criterion. The Executive Order which requires such compliance is a major driver in DOE decision making. The recent DNFSB discussions have focused on the fact that the DOE standards which rank high among the issues monitored by the Board and about which it tends to develop recommendations actually rank among the least severe consequences in this compliance rendering of the RPP.[18]

Figure 8 – Fifth Key Element of the RPP

Process for incorporating non-discretionary compliance requirements

Commentary: For the manager contemplating impacts that result from his/her compliance-related decisions, the effort effectively to incorporate compliance requirements into the funded list of the IPL remains a major issue. What happens if there is a major discrepancy between what the Site is being required to do and what it should actually be doing in order both to protect receptors from risk and/or most effectively move toward completion of a project. A credible risk ranking process for EM would provide a useful format to help resolve such potential discrepancies. It would enhance ongoing dialogue between the Department and its regulators to consider more fully both risk protection and efficiency during the process of making decisions about regulatory compliance and accommodation. Very simply, the Site must find a way to incorporate and use in a transparent way what it learns in the course of doing the studies which form the basis of compliance activities, to create a system that it uses to rank and order its priorities (CRESP Peer Review Committee, 1999). There is currently no effective system for demonstrating to regulators and/or the public that the Site has wed these two processes. And the RPP process is currently a hindrance and not a help to this process.

Figure 9 – Final Key Element of the RPP

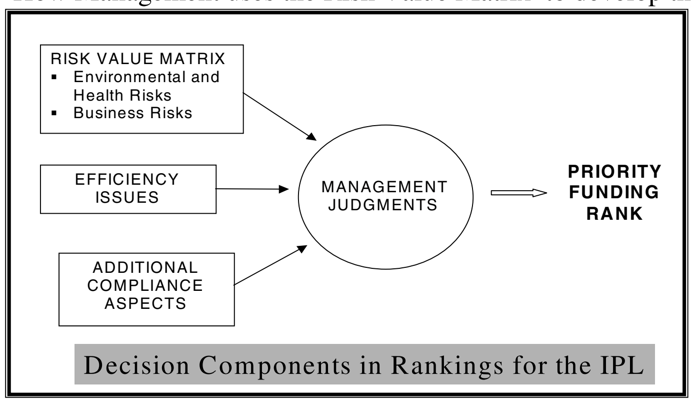


The actual **Integrated Priority List** resulting from risk calculations + managerial judgment with cumulative costs and delineating funding cutoff points

18 There remains a continuing debate as to whether the matters regulated by the Department itself should be regulated by another federal entity.

Finally, the combination of the information derived from the Risk Value Matrix and its various sorts, is combined with a check to assure compliance with non-discretionary standards and an effort to adjust the entire work of the Site to address other managerial factors (See Figure 9). "The IPL is the list of work packages that SRS plans to accomplish, based on the risk of each criterion in the model, and management judgment. The IPL is a budget-planning tool that SRS uses for similar purposes. The IPL includes, in priority order, the work scope that SRS plans to accomplish and includes its associated budget requirements." (see Attachment E) We try to capture this set of factors in Figure 10:

Figure 10 - How Management uses the Risk Value Matrix to develop the final IPL



The results of this initial first part of the CRESP inquiry are the following. CRESP finds the SRS Risk Prioritization Process to be made up of many well-conceived pieces of a surprisingly coherent process, which has been used with impressive consistency for five years. The judgments made in the process are consistently converted into quantitative evaluations in accordance with commonly defined criteria, and hence they are surprisingly transparent. Further, as the process was being developed, key elements of it were both defined and "weighted" in dialogue with the public, and both the process and its results are annually explained to and vetted with the public. But we have also noted that there are fundamentally important issues left unaddressed by the current system.

In the following pages we lay groundwork for what we expect would be a quite significant reform of the current RPP system.

- We recommend a process that would preserve the benefits of the current RPP system and build toward a process that promotes the robust use of risk information in the longer-term management and eventually the effective stewardship of the Site. Because the risks defined and ranked in this one RPP system where the Site pulls together all its activities are evaluated for only a single year's delay, the Site lacks a sufficiently robust use of risk even to make sure that the SRS funding process does not ignore any one activity which could have major consequences for the risk to the public, workers, and the environment or to its own continued efficiencies.
- We will begin by looking at the actual results that emerge when one examines the quantitative rankings from the RVM and compares the quantitative rankings to each other and to what actually emerges in the final IPL. This examination is conducted in Section II.
- Then we will turn in Section III to an identification of the fundamentally new kinds of factors which would have to be added to the current system to enable it to become a tool for a multi-year

calculation (not a single year) of where risk can help the Site determine and weight where SRS priorities should be focused.

- Finally, we will turn to a review of specific categories and criteria where modest changes in the way that the Site defines and grades its problems would yield a better system even if the major changes were not made. (Section IV)

Section II. Analysis of the Rankings and Scores that Emerge from the Current Risk Value Matrix

Any examination, even a cursory one, of the quantitative results of the application of the Risk Value Matrix raises serious questions of many sorts. The database is rich; and that is why so many probing questions can be asked of it. When the actual results of the RVM are scrutinized, one key anomaly emerges: The categories that actually end up with the highest score in the RVM are consistently the business efficiency categories. And so those criteria actually dominate the quantitative selection process in a way that causes the risks that examine the impact on receptors to be almost completely lost. Why does that happen? What might it mean?

Figure 11 - The Risk Value Matrix Criteria with the highest values assigned to each scenario

Risk Value Matrix: The Receptor Criteria

A. Public Health & Safety

	Very High
A1. Release above Normal Limits	1
A2. Release Greater than Allowable	70
A3. Minor Injury, Exposure> 0.1 Rem	550
A4. Exposure 0.5 Rem	790
A5. Major Injury, Exposure > 25 Rem	1880
A6. Single Fatality, Exposure > LD 50	3000
A7. Multiple Fatalities, Exposure > 50	*

B. Environmental Protection

	Very High
B1. Release Greater then Normal	1
B2. Release Greater than Allowable Limits	30
B3. On-site contamination > 10K	70
B4. On-site contamination > 100K	230
B5. Off-site contamination > 1,000K	1080
B6. Severe Multi-media Contamination	1880

C. Worker Healthy & Safety

	Very High
C1. Occupational Injury Requiring Medical Attention	30
C2. Skin Contamination	70
C3. Lost Time Injury	130
C4. Major Occupational Injury	230
C5. Exposure > 25 Rem or Requiring Hospitalization	1080
C6. Single Fatality, Exposure > 50 LD	2400
C7. Multiple Fatalities > 50 LD	*

**no values defined*

F. Safeguards & Security

	Very High
F1. Theft of Government Property	1
F2. Sabotage of a Non-nuclear Process	30
F3. Theft of Classified Material	70
F4. SNM Inventory Imbalance; Loss of Accountability	370
F5. Sabotage of Nuclear Process or Facility	550
F6. Outsider Penetration of MAA	1440
F7. Loss of Weapons Quantity of SNM	3000

Risk Value Matrix: The Managerial Risks

Compliance with Standards

	Very High
D1. Deviation from Good Practices Non-compliance	1
D2. Violation of DOE Admin Requirements	30
D3. Non-Compliance w / DOE Tech Req.	130
D4. Law Violation, Fed/ state law or Compliance order	230
D5.Law Violation may result in Civil Penalt	550
D6. Law Violation may result in Criminal Penalties	790

E.Cleanup Mission/Business Efficiency

	Very High
E1. Reduced Contingency; Increased Investment < $1M Annually	10
E2. Internal Plant Milestone Commitment Missed	30
E3. Site Commitment/External Plant Milestone	130
E4. Program Disruption(>1Month)	550
E5. Extreme Program Disruption (>6 Month)	1440

Public & Community Relations

	Very High
G1. Minor Public Distress or Attention	1
G2. Spot Media Coverage	10
G3. Disregard of Civilian Recommendations	70
G4. Protracted Public Comments or Concerns	370

Cost Effectiveness

	Very High
H1. Minor Increase in Investments or Operational Savings	10
H2. Moderate Increase in Investment or Operational Savings	70
H3. High Increase in Investment or Operational Savings	230
H4 Extreme Increase in Investment or Operational Savings	370

Let's step back. As noted earlier, the RVM seems to be devisable into two basic groups of criteria or attributes: there is one group that appears to assess the consequences for the environmental challenge that would result from a one-year delay in the activity. There is a second group which, because of the way the criteria are graded, measures the managerial impact of a delay of the activity. This point is not easily made without the 2 diagrams in Figure 11, one showing the criteria where consequences for the health, safety and environmental challenges were measured and the second showing the categories where the severity of managerial impacts were measured. Figure 11, then, shows the eight criteria divided into the two types just discussed. We provide the four criteria[19] and the consequence options (reflecting lesser to greater severity) for each and also show the numerical value assigned to the criteria when the risk is very high (likely to occur within one year if activity stops).

It should be noted that since the publics' "weightings" have been directly built into the criteria themselves, those criteria that were ranked highest in importance by the Site publics are given a higher numerical **"potential."** Hence, as we saw in Figure 4 (p.14) Public Health and Safety and Safeguards and Security (both ranked 1.0 on the 1 point scale) have the highest potential scores. (See Figure 11) Criteria like Compliance and Cost Effectiveness are given lower potential scores. Note also[20] that the definitions of what counts as severity differ among the criteria[21].

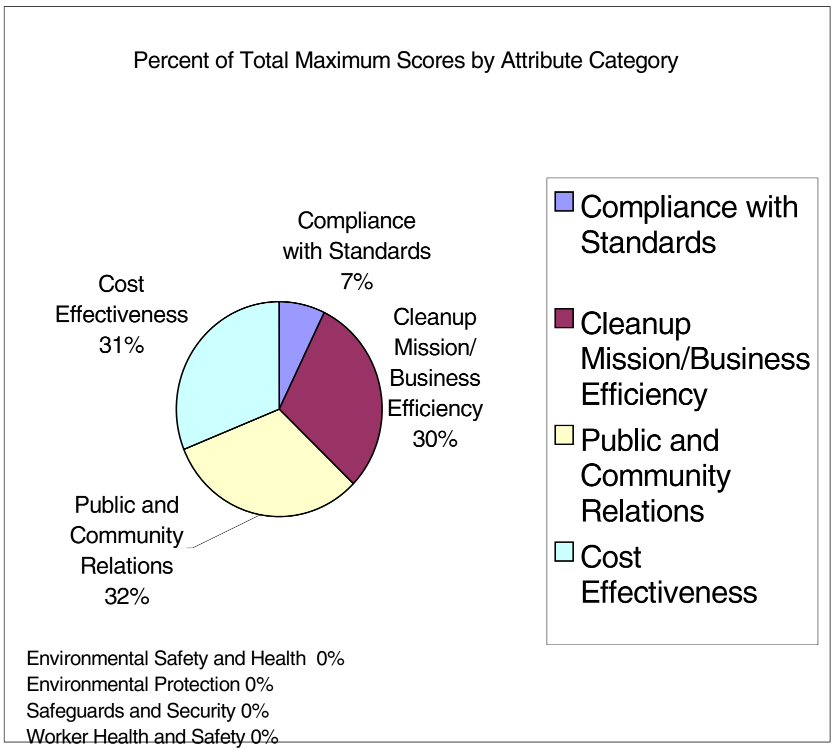
In the sharpest possible contrast to the **potential** numerical scores for these eight criteria are the **actual** SRS numerical evaluations of several specific criteria. Two characteristics of the rankings first caught the attention of CRESP reviewers. First, we noted that the actual rankings of the work packages being evaluated were dramatically different from one criteria to the next. Work package rankers had at least 20[22] severity + consequence options from which to choose every time they ranked a work package criterion. In an equally distributed ranking process, each score would be chosen 3 to 5% of the time. But we noted that for some criteria the highest score was never chosen and in other cases it was chosen regularly or even typically. Figure 12 shows this in diagrammatic form, with the pie chart indicating which four criteria the Site's rankers ranked with maximal scores and which criteria they never cited as having a maximal score among the work packages. Figure 13 shows the percentage of the total of such maximum scores reached for each RPP criterion. Nearly one-third of all the maximum scores were achieved by each of three criteria: Public and Community Relations (32%), Cost Effectiveness (31%), and Cleanup Mission/Business Efficiency (30%). The rest of the maximum scores were in the Compliance with Standards category (7%). But in NO case were maximum scores reached for the Public Health and Safety, Environmental Protection, Worker Health and Safety, or Safeguards and Security criteria. This finding led us to explore additional characteristics of the rankings. We found that for the 129 IPL work packages that were eventually included in the funded category, there was, in fact, a true disparity between the quantitative scores given to the four categories where impact on receptors was assessed and those given to the four criteria where the impacts were on managerial factors. A review of Attachment D will give the

19 Since the criterion Mission Viability was never quantitatively ranked, we do not show it here.
20 As is discussed at greater length in Section 4
21 Of greatest significance is the fact that the three middle categories for Environmental Protection are not actual impacts but are instead relative costs associated with the cleanup of the environmental release should it occur. This will be important later in this section, as is discussed in greater length in Section 4.
22 and sometimes as high as 32

reader a good sense of this.

We then looked at the actual IPL rankings, where we found that work packages where receptor risks ranked highly rarely ranked high in the IPL. This general impression is then supported by diverse data. If one adds up the totals that the raters gave to the Mission Impact /Business Efficiency category for all of the work packages that fall within the funded range of the current IPL, the raters have given that criterion a numerical total of more than 110,000. Similarly, the category of Compliance with Standards had been given a total of about 70,000. But the total number given in the same selected work packages for all **three** categories most associated with receptor risk (Public Health and Safety, Environmental Protection and Worker Risk) summed together come to a numerical total of less than 30,000.

Figure 12. Which Categories do evaluators give the highest possible scores?



We looked at these patterns in several other ways as well. Risk Value Matrix scores for approximately 200 SRS work packages are listed in Attachment D. We have further grouped the higher scores into three categories, 1000 or more, 500 to 999, and 100 to 499 (Table 1). Scores less than 100 were likely to be less influential on final ratings, and were not further evaluated in this review. The Cleanup Mission/Business Efficiency criterion received 75 of the 77 scores greater than or equal to 1000. Environmental Protection and Worker Health did not collect any rating of 1000. Indeed, contrary to initial stakeholder maximum score potentials, Worker Health and Safety, Public Health and Safeguards/Security[23] rarely scored high in the matrix – with only two scores among the work

23 Nowhere in this entire report do we deal adequately with the Safeguards and Security category and the high priority it has been given by the SRS public as a factor to be considered in the risk matrix. We have focused on the relationship of the three "receptor" risk categories and how they are evaluated relative to the "managerial" criteria. The nature of the materials traditionally used and developed at SRS and currently stored there, and the future mission of management of such materials in the future make this an exceedingly important decision-making consideration – some think it to be the priority risk issue at SRS. Either it does not finally belong in this matrix of risk factors because it needs to be pulled out and treated separately, or it deserves far better than a low-scoring and low-ranking issue that in this managerial decision-making scheme, one that appears to place it far lower than business efficiency. Should CRESP do a second phase

packages being scored higher than 500 for any of the three criteria. Over half of the scores in the 500-999 range were assigned to Compliance with Standards, with the residual pretty evenly divided by Environmental Protection and Cleanup Mission/Business Efficiency.

Table 1.
Comparison of SRS Weighted Scores by Nine Attribute Categories

ATTRIBUTE CATEGORY	Number of Scores for Attribute Category			
	≥1000	999-500	499-100	Total
Public Health and Safety	1	0	1	2
Environmental Protection	0	30	24	54
Worker Health and Safety	0	0	23	23
Compliance with Standards	**	85	63	148
Cleanup Mission/Business Efficiency	75	35	21	131
Safeguards and Security	1	0	24	25
Public and Community Relations	**	**	79	79
Cost Effectiveness	**	**	90	90
Mission Viability	NR	NR	NR	
Total	77	150	325	552

**** =Beyond maximum possible scoring limit for noted category.**
NR = Not rated (rating scores not published in publicly available reports)
Note: Each cell lists the number of items that received scores in the noted range for the given attribute.

Table 2 lists the nine categories, their maximum possible scores, and both the number and percentage of times that the maximum score was reached. For example, the maximum potential score for Public Health and Safety is 3000, but as already noted, it received no scores at that level. In contrast, Cost Effectiveness, Public and Community Relations, and Cleanup Mission/Business Efficiency reached their maximum possible scores about forty- percent of the time that they were rated. Compliance with Standards had its highest possible scores about ten percent of the time it was rated.

review, explicit consideration of what should be done with this Safeguards and Security category of risk concern and managerial focus will be given the explicit attention it deserves.

Table 2.
Number and Percentage Distribution of SRS Maximum Scores by Nine Attributes Categories

ATTRIBUTE CATEGORY	Maximum Possible Scores	Number of Times Maximum Score is Assigned	Percentage of Times Maximum Score is Assigned
Public Health and Safety	3000	0	0
Environmental Protection	1880	0	0
Worker Health and Safety	2400	0	0
Compliance with Standards	790	18	9.3
Cleanup Mission/Business Efficiency	1440	75	39.1
Safeguards and Security	3000	1	0.6
Public and Community Relations	370	79	40.5
Cost Effectiveness	370	78	42.2
Mission Viability	1080	NR	NR

NR = Not rated (rating scores not published in publicly available reports)

There are several explanations for what we have seen in these tables. The first is that there are really only modest risks for receptors associated with the delay of any activity at SRS for a year, even those associated with min-safe activities. That conclusion would support various other inferences. It could support conclusions generally about risks being addressed by the EM program: **either** that the RVM is not capturing anything very significant about the longer-term risks **or** that there are, in fact, few serious risks associated with any EM problems at the Site. We find that analysis inconsistent with our own discussions with SRS staff personnel and our knowledge of what would occur if materials at the Site were not effectively managed. A second kind of conclusion would be that the rankers really are focused primarily on the efficient operation of the Site and consider that to be the primary focus of work: that is, to create the most efficient schedule of activity and to avoid costly delays. A third kind of conclusion is that the definitions of the receptor risks used in the RPP and specifically in the Risk Value Matrix do not capture the actual nature of the dangers of the receptor problem at SRS and instead capture only those problems directly addressed by currently planned activity and that these problem definitions are systematically those which would not involve risks in any one-year delay. That conclusion would, of course, be the most troublesome since it would suggest that what the Site plans to address in its activities may or may not be addressing the most serious problems.

Doubts about whether the current RPP is defining its targets well become stronger if one examines the Environmental Protection criterion. As we will see, it was the receptor criterion that received the highest scores. We look first at the way in which the graded consequences for this criterion were defined. The least-severe graded consequences are defined as exceedences to environmental standards, the other more severe consequences are associated with **costs of having to cleanup a release, either on-site or off-site**. Examination of the evaluations actually given to work packages for this criterion suggest that in doing their scores, the work package rankers simply drew a geometric relationship of the annual cost of the activity to the likely cost of cleanup. Hence, less expensive annual activity costs yielded lower environmental protection rankings; higher annual activity cost projects rated a higher consequence score for the environmental protection criterion in the work package. As we discuss at greater length in Section IV, this environmental protection criterion's matrix really is not made up of a coherent set of scenarios by which to evaluate the impact on the environment of SRS problems and may not be reflecting anything of significance at all about the environmental impacts or the ecosystem's vulnerabilities associated with the specific problem the activity is addressing, and certainly not the injuries likely to result from cleanup.

Why does it matter if we decide that the environmental protection criterion, as defined and evaluated, is systematically deficient, possibly misleading, and should in its current form be dropped as an indicator of receptor risks? The answer is that the scores generated by the troubled Environmental Protection category accounts for a full 2/3's (20,000) of the numerical totals associated with the Total Safety Category that lumps the three receptor criteria (PH&S, EP and WHS). In fact, the numerical total for human receptors for the 129 funded work packages is about 10,000 (with two-thirds of that total generated by the public health consequences and one-third by the worker risks consequences). If one concludes that the EP category is not a reliable indicator of receptor impacts, then for the two remaining receptor impact categories (Public and Worker Risks) the numerical totals together equal only one-seventh of the weight assigned in the rankings to the Compliance with Standards criterion and less than 10% of that assigned to the Mission Impact/Business Efficiency criterion. As we noted, this is all the more remarkable because of the high **potential** scores for these receptor risks as compared to the potential scores for the managerial risks (Again, compare the two tables in Figure 11).

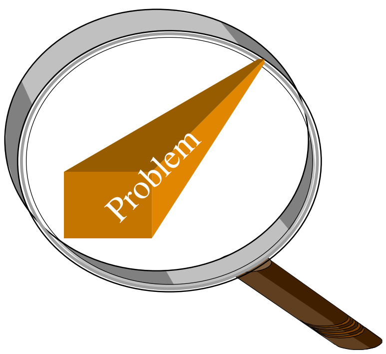
What does this analysis of the RVM scoring results mean for the way in which the Site sums up its activities into the IPL. Do, for example, key criteria that achieve lower scores actually reappear to shape the final IPL? The answer to that question is not simple. It is true that the RVM total rankings and the IPL rankings are basically congruent for the first 30-35 work packages in the current IPL. But there is thereafter a significant divergence The differences can be as pronounced as a discrepancy of more than 50 places on the IPL for perhaps a third of the remaining projects. That is to say, the IPL rank will be more than 50, and up to 100, project places **different** than that place that would have been dictated by looking at the total Safety rank for as many as a third of the remaining projects on the list.[24]

---

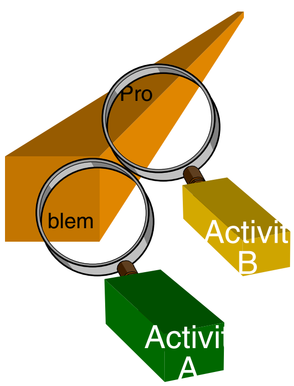
24 There is another possible explanation that is worth at least describing. It is apparent that the *threshold may be too high* to reach maximum scores for other categories (e.g., Public Health and Safety). A re-assessment of the types of items that make up the consequences list may be in order, since they are highly influential regarding both score potential and types of information collected throughout the rating process. In addition, a review of the data collection and rating process, as well as interviews with people contributing to the process, could reveal unintended factors that have the potential to unduly influence scoring outcomes. For example, it is possible that

As the anomalies pile up, one senses that the current scheme and the quantification it captures is simply at odds with what is intuitively known about the Savannah River Site. At the Site are stored enormous volumes of a very diverse set of radioactive materials. Hundred of millions of dollars a year are spent to make sure they remain stable. There are hundreds of places at SRS that have been identified as sources of release of both radionuclides and other hazardous materials and some of these will, unless intercepted, be released off-site. And yet the elaborate system established to quantify literally thousands of specific judgments about the risks associated with the activities that address these problems rank the challenge of assuring management continuity far higher than it does the risks that the management system was established to address. It would appear that the distortion occurs because the metric for evaluation is what will happen if an **activity** is temporarily delayed.

Figure13: What needs risk evaluation first and foremost is the environmental problem which must be solved. Do we see it whole ..



Or through work package lenses held up to the problem that that may distort it?



But now, to the most interesting phenomenon. While the actual IPL listings do not appear to correlate very well with the Total Safety category, the fact is that they do not correlate very well with ANY of the sort rankings irrespective of how the sorts are separated or clustered. We have noted in Figure 10 that the IPL is generated by a combination of factors that include, in addition to the RPP quantification, two other factors, management's consideration of other factors, including other compliance factors and managerial judgment. One is fairly forced to the conclusion that the current system is not working as a guide to managerial decision-making, except in situations where short-term suspension of activity would threaten min-safe conditions. Activities which do provide that kind of protection may be ranked very high; but there is nothing **in this RPP** that provides any assurance whatsoever that there are not other problems that pose risks or even threats to minimum safety and yet are not yet being addressed in the RPP because they are not a funded or ready-to-be funded activity. For all the elaborate scoring, the RPP does not seem to provide the Site and its stakeholders with the kind of evaluative mechanisms needed to make sound risk-based decisions for an EM program at the Site that is

---

certain categories receive higher ratings because the function of those categories are easily understood, and the impact of a dysfunction could easily be visualized. Other groups may have equally important potential impacts, should dysfunction occur, but may be less easily visualized without specialized knowledge or clear program advocates. In a partially subjective rating system, it is important to monitor the program for these possible disconnects between actual risk potential and group risk perception (and thus, rating of scores in the RVM).

projected to require 30 to 40 years of additional cleanup work.

[This section was intentionally left blank.]

Section III. The Major Additions needed for a Robust RPP

Two issues have dominated discussion of weaknesses of the current SRS RPP process in this report. One has had to do with the confusion caused by the scoring of the risks posed by the **problem** as compared to risks associated with a short delay in the **activity** intended to address the problem. The confusion in the SRS RPP between problem and activity risks appears to us to create both impaired vision and even cognitive dissonance.[25] Our first task is to see the problem: its size, shape, extent, etc. and see it whole. We have suggested that the current SRS RPP, which primarily evaluates and lists activities, inevitably has the lens, through which it "sees" the environmental problem, focused on the activity designed to address the problem (Figure 14A). We believe that is the wrong "subject."

There are three reasons why focusing on "the problem" is essential: (a) the evaluation of an unvarnished definition of the problem and its effect on receptors establishes the basis for any EM activity; (b) only when the problem and its risks are seen first does the invitation stay open to rethink the options for ameliorating activity, if the problem requires such a change (and this will not happen when only the activity is the subject of prioritization); and (c) when the sole "subjects" of prioritization are the set of activities ready for funding and implementation, they may well obscure the fact that there are other problems which need attention, even priority attention. We are quite confident that any extensive program of risk prioritization which does not have as its first and primary "subject" the environmental problem(s) at the Site impairs the entire process and invites a threat that major problems have no spotlight put on them. The SRS RPP needs a fundamentally new way of presenting the relationship between problem and problem-solving activity.

The second issue discussed throughout the report has been the anomalies and potential misunderstandings caused by the fact that the sole purpose of the Risk Value Matrix has been to measure the impact of a one-year delay of an IPL activity. It is self-evident that in a program like the EM program at SRS the problems that the ameliorating activities address may be longstanding and the implementation of the remedies for the problems may take many years. Further, in many cases, maintenance or containment activity(ies) to maintain a minimum safe status for the problem have already long been in place and do stabilize the risk posed by the problem for many years during which a new technology to address the problem is developed and later applied (Figure 14C). A metric that poses only two options – a one-year's delay or full speed ahead -- drives from view most of the real long-term and expensive dilemmas of managing the EM program. Indeed, we believe it is a too-simplistic a metric addressing a short-term problem which does not deserve the complex process devoted to it in the SRS RPP. Most important, the short term focus of IPL cannot be the surrogate for the much broader range of issues for EM's work that deserve risk-based thinking and decisions. We believe that the one-year's delay metric actually may mask more about risk analysis

25 Figure 14 (Page 31) schematically illustrates the process of resolving environmental problems over time through targeted risk reduction activities under two different scenarios: 1) technology currently in place for Site management (Figure 14B), and 2) technology developed in the future (Figure 14C). The environmental problem is understood to be one which presents itself as both a risky situation and one which is expected to have a long "tail" with resolution taking some time to achieve.

and strategic thinking than it reveals about risks of the EM program and the priorities it reflects.

We have suggested that three significant changes would need to be introduced into the RPP process to make it responsive to the concerns we have introduced in Section II and discussed thus far in Section III.

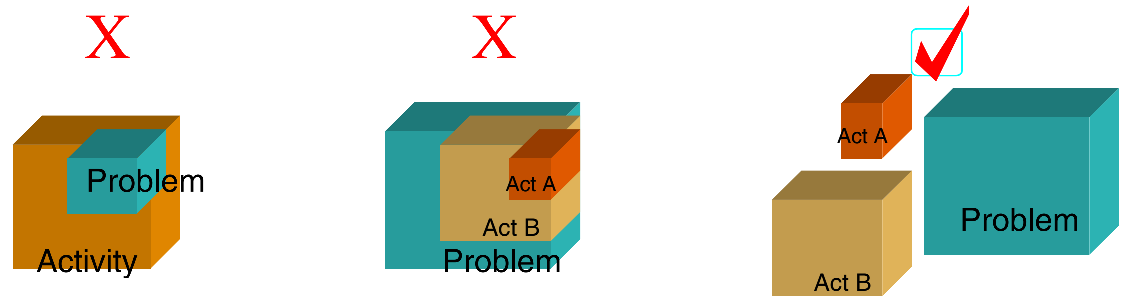
- First, a revised/reformed process would need to **define a baseline risk generated by the problem** and incorporate both an evaluation of risks associated with the activity itself **through the life-cycle** of the risk-reducing project **instead of only focusing on one-year delays**, and that the target risk reduction should be defined as well.[26] Put differently, we think that the "subject" of the risk evaluation process should be the problem and with it the activity or activities which the Site has designed for addressing it as they will be deployed to get the problem under control over time. Hence, the list of priority problems to be captured by the IPL would be derivative of this analysis
- Second, the RPP process should include a method for **ongoing tracking of "progress" made in respect of the evaluated risks.** It is essential that the recent history of implementation of the ameliorative activities be integrated with the data used in the prospective RPP process, so that in setting priorities the success /failure of the most recent efforts are clearly seen
- Finally, the RPP would need to incorporate[27] or **reference alternative approaches to the problem,** with at least some exposition, so that other ways to address the problem could be readily seen if cost-cutting or delays were required or the current technology failed to achieve its goals. Note, these alternatives will have been evaluated in the process leading up to the selection of the preferred activity; our point is that they should continue to be integrated into the database until the problem is actually resolved.

26 This is true whether or not additional stewardship care or monitoring requirements are expected.
27 Either directly as part of the RPP itself or as part of a linkable data base.

Figure 14: Resolving problems over time through targeted activities.

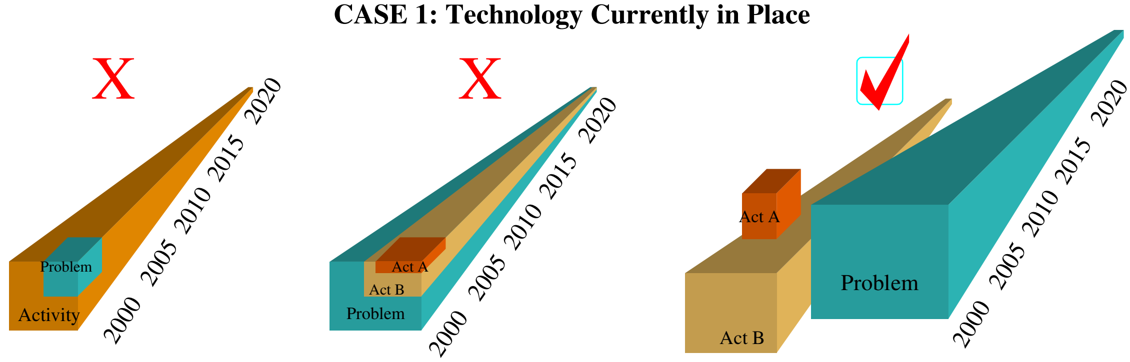
A. We are suggesting that the problem should not just be imbedded in the activity(ies). The location-specific problem itself needs focus and definition so that the separate activities designed to address it can be clearly related to the problem.

(X's refer to less desirable approaches than the ✓)



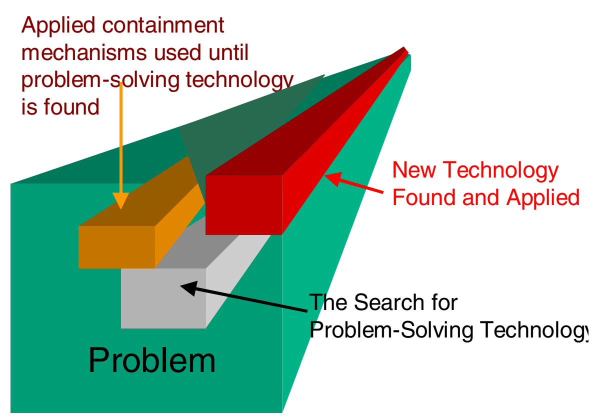
B. We are also suggesting that the time frames for both the problems and the activities needed to address them should be explicitly included so that the scope and duration of the entire project is seen clearly related to the time frame needed to both contain the problem and then resolve it.

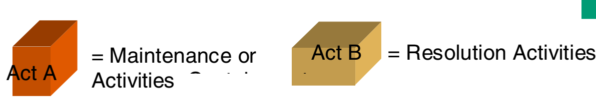
CASE 1: Technology Currently in Place



CASE 2: Technology Developed in the Future

C. In many cases, the actual remedial or ameliorating activity will not have been selected (or even developed or discovered), though activity needed to preserve min-safe conditions will have been initiated

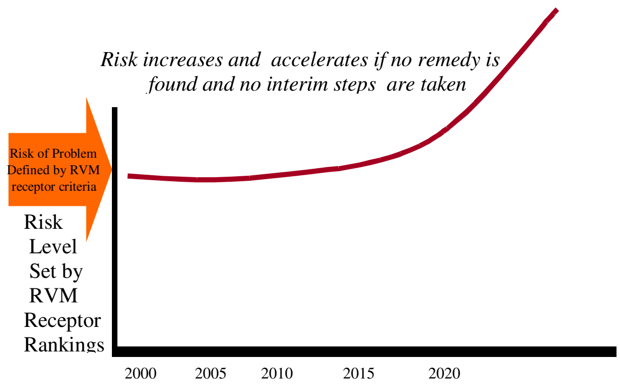




Several pictures may help explicate these three ideas (Figure14).

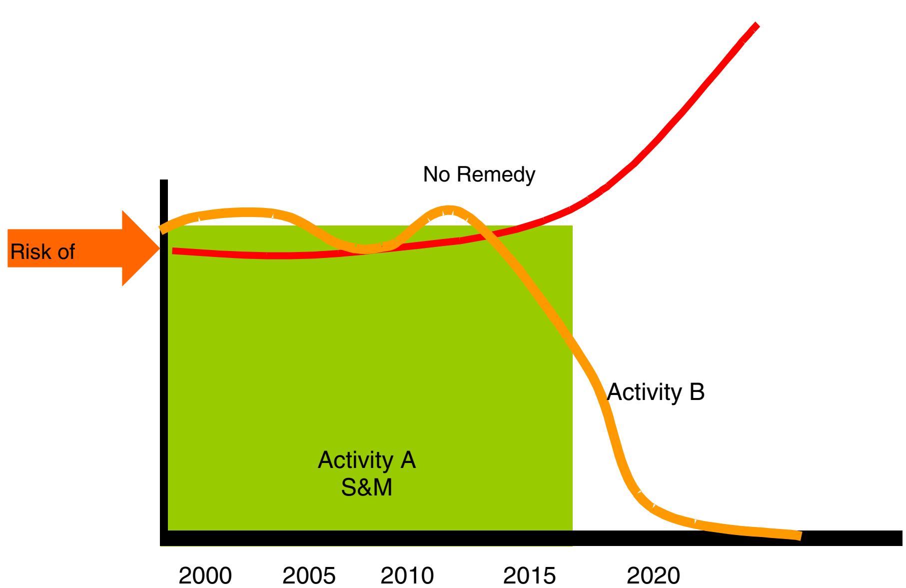
If the problem and activity subjects and the time frames are included, then it should also be possible to use a modified version of the SRS Risk Value Matrix to score or grade the several elements needed for eventual inclusion in the IPL. In order to illustrate, imagine the 100 + location-specific Site problems as the primary subjects of the evaluation and as forming the matrix within which ameliorating activities sit. The significance of the risk to receptors, as posed by the problem (and as scored by the receptor criteria of the RVM – see Figure 11), would be seen on the vertical axis; the expected duration of the problem and what will happen to the risks over time would be seen on the horizontal axis. Figure 14 graphically shows the matrix and the red line reports what will happen to the risk if the problem is not addressed.

Figure15: The Problem depicted as a Matrix with receptor risks and duration as the major coordinates.



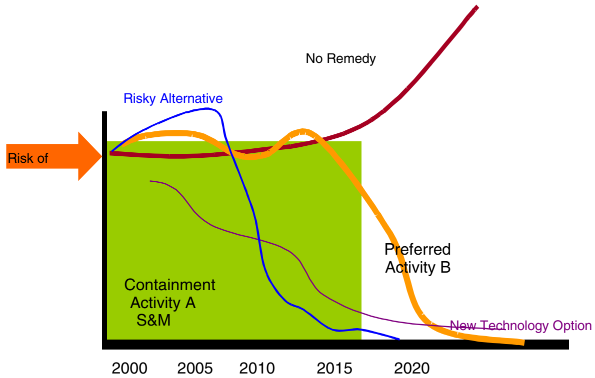
Now the activities that are designed to address the problem are set within the matrix in Figure 15. On the one hand are the activities designed to simply contain the problem – to create min safe conditions that would not exist except for the surveillance and maintenance process. They are represented by the solid shapes. (Activity A in the figure) On the other hand the activities that are intended to solve the problem or to reduce the problem's baseline risk – are represented by the orange line. Note that the path cut by the risk reducing activity is not continually downward – as risks are created by the remedy in the course of finally addressing the risk posed by the problem, and the min-safe activity protects until the reduction begins.

Figure 16: The risks from the problem are addressed by min-safe activity (seen in the green square) Meanwhile, implementation of the preferred remedial risk reduction activity goes to work to remedy the problem.

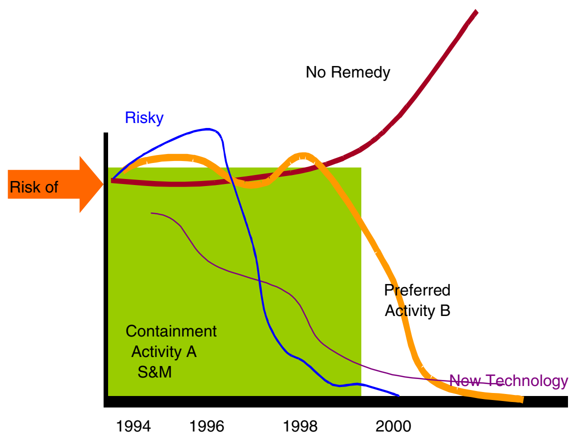


In our approach, we have used a modified Risk Value Matrix to define the how risky the problem is for receptors. But a key issue for the RVM is how programmatic risks (efficiency, mission impact, cost -effectiveness) are factored into the process. These risks too are included in the full RVM (Figure 11), and they are needed to complete the picture in a more robust RPP leading to an IPL. This too can be depicted. In Figure 16, the more complete risk profile of a problem and the activities needed to address it are seen. There may well be ways to reduce costs of S&M activity. There may be advantages to waiting for technology to develop because either the costs of the alternatives are too high or an alternative that achieves faster risk is itself too risky. Note that in Figure 16, we show that the dates measured can be either prospective, as in the case of a new problem, or historical, in showing what has been done to begin risk reduction earlier, etc.

Figure17: Alternative risk reduction technologies are portrayed by the several lines which show that faster options (blue line) may be more risky or that new technologies (as depicted in the purple line) aren't ready yet.



It is important to note that the start date for this new way of conceiving the relationship between EM problems and the activities needed to address them should typically be retrospective to the date when ameliorating activity began, as illustrated below by showing that the start date is 1994



But note the min-safe activity can also be adjusted as is seen here where the transparent light green portrays a better min-safe protection until the risk reduction has been achieved

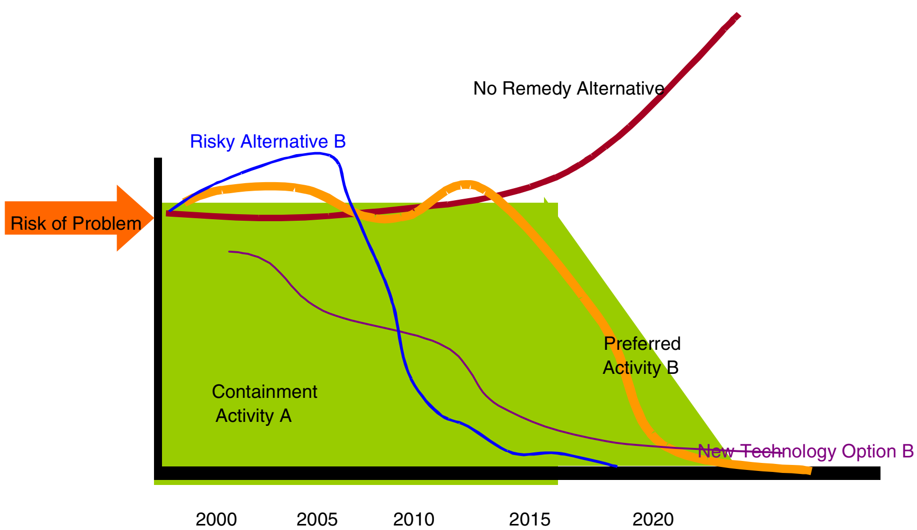
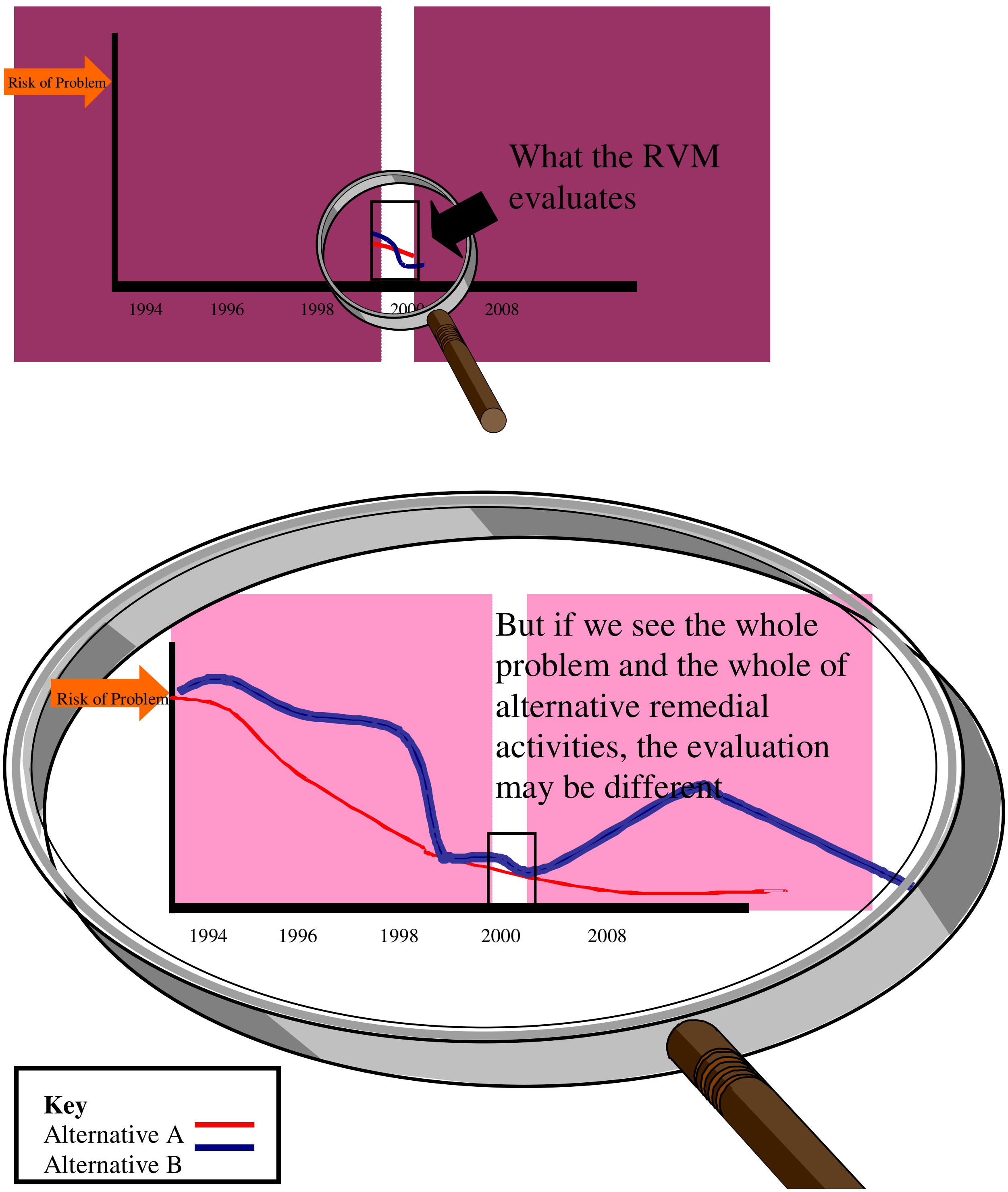


Figure 18: Does the fact that the RPP's relies on a Risk Value Matrix whose sole focus is to evaluate risk from a year's delay actually affect how risks are seen and interpreted at the Site?



Note, we assume that whereas the problem is graded for risk and the risk reductions achieved by ameliorating activity are tracked by the system, the activities themselves would still need to be evaluated for their business and programmatic risks. Indeed, with modest additional effort, this more robust process should dramatically improve the clarity and provide temporal perspective. And, as a result, the improved RPP could be defined to meet the three objectives described at the beginning of this Section.[28] The graphic formats used in Figures 14-18 have been used to sketch out how the existing or modified RPP process could be used in a system that forced the Site to identify all of the EM problems of which it is aware and to link activities (often more than one) addressing those problems in a way that makes more transparent what technology needs exist, when to slow down and speed up efforts to introduce problem solving activities and when to phase out risk maintenance or containment activities and the like.

Before trying to relate these ideas to conclusory remarks, we turn in Section IV to an exploration into how the specifics of the RVM could be improved, particularly in relation to receptor risks.

28 While the format is different, and while what we have described might be grafted on to the existing system we would note that the formula that underlies this discussion is one developed by the CRESP Peer Review Committee in 1996. There the question posed was how to integrate receptor-risk concerns with the need to invest in mortgage reduction activities. (See Peer Review of the FY 1998 Budget Formulation Process of the U. S. Department of Energy Office of Environmental Management, Peer Review Committee of the Consortium for Risk Evaluation with Stakeholder Participation [CRESP] July 31, 1996, p.5, where the concept of rolling stewardship is first developed)

Section IV. Interim Steps to Reform the Existing Process: Rectifying Problems with the Criteria and the RVM that Explicates Them

In the following section, we step back from the major missing elements of the RPP process and focus instead on how modest revision of the definitions and depictions and examples that guide the application of specific criteria used in the current RPP could achieve immediate improvements.

The Risk Value Matrix, which evolved from numerous stakeholder meetings and deliberations, assigns scores to each combination of consequence and the likelihood of consequence occurrence. Such a scoring system, by its very nature, must combine subjective values with semi-quantitative measures to arrive at final ratings. This combined reasoning is part of the strength of such systems (it can integrate a wide range of information across stakeholder groups into a summary index), but it also can be susceptible to the strong perspectives of dominant members or aligned working groups in the team performing the rating. It is important to periodically assess the ratings by attribute category. Feedback from such analyses to the team should encourage fine-tuning of the system over time. As we observed in Section II, the categories of Public Health and Safety, Worker Health and Safety, and Environmental Protection, which are the cornerstones of any risk evaluation, were ranked as low-priority items, receiving very low scores within each class. This is in contrast to perceptions of the SRS Citizens Advisory Board (CAB) who classified the Public Health and Safety category as one of the most important criteria to be considered in weighing and ranking the various criteria (SRSCAB 1995b). The reader should refer to Section III.

As implied earlier, then, the *threshold for the receptor criteria may be too high* to permit to be ranked the receptor risk criteria (e.g., Public Health and Safety) consistently with the other RVM criteria. A re-assessment of the types of items that make up the consequences list may be in order, since they are highly influential regarding both score potential and types of information collected throughout the rating process. In addition, a review of the data collection and rating process, as well as interviews with people contributing to the process, could reveal unintended factors that have the potential to unduly influence scoring outcomes. For example, it is possible that certain categories receive higher ratings because the function of that category is easily understood, and the impact of a dysfunction could easily be visualized. Scenarios identified by other criteria may have equally important potential impacts, should dysfunction occur, but may be less easily visualized without specialized knowledge or clear program advocates. In a partially subjective rating system, it is important to monitor the program for these possible disconnects between actual risk potential and group risk perception (and thus, rating of scores in the RVM).

Further, as we see below, some of the RVM categories rate discretely different dimensions and therefore are not parallel in their definition. That is, Public Health and Safety uses sub-categories that involve injury, exposure and fatalities; Environmental Protection uses sub-categories that involve clean-up costs; and Worker Health and Safety involve injury, lost time, exposure and fatalities. The sub-categories are therefore not parallel or equivalent. All three could involve the clean-up costs necessary to remove the risk, and all three could involve exposure and fatalities. Further issues, discussed in subsequent sections, relate to the adequacy of consequence gradient/components, likelihood index, scoring, and attention to potential bias.

Finally, although we primarily focus in this section on the three RVM criteria concerned with the impact on receptors (public, worker and environment), we also evaluate the ways in which two other criteria, cost effectiveness and public and community relations are evaluated in the Risk Value Matrix.

IV.1 Public Health and Safety

The following subcategories under the Public Health and Safety category were assigned a weighted score in the RVM.

A1. Release above Normal limits
A2. Release Greater than Allowable
A3. Minor Injury, Exposure > 0.1 Rem
A4. Moderate Injury, Exposure > 0.5 Rem
A5. Major Injury, Exposure > 25 Rem
A6. Single Fatality, Exposure > LD 50
A7. Multiple Fatalities, Exposure > LD50

In general, the risk characterization for public health integrates information from the hazard identification, dose-response, and exposure assessments, using a combination of qualitative information, quantitative information, and information about uncertainties (NRC 1994, EPA 1986, EPA 1995),[29] and the categories (i.e., A1 through A7) are reasonable and useful for ranking risks. Minor changes could make the process more transparent and scientifically clear. Hence, although some of the categories listed above indicate graded steps in threats to PH&S, several may need reconsideration. The PH&S ranking system focuses on i) fatality; and ii) potential level of exposure as a result of an environmental release or on the emission rate as a surrogate for exposure concentration to assess risks to public health.

Although the categories of A1 and A2 are not necessarily related to public health and safety, they do assess the compliance status of the Site activities, and are pertinent. Any contamination at levels above the background level may be of concern for off-Site populations who may come into contact with the contamination (e.g., groundwater concentrations). However, it should be emphasized that the allowable limits established by the regulatory agencies are not always based on protecting human health. Different criteria (e.g., odor, technical feasibility, available maximum control technology), often used to establish allowable limits for chemical releases, should be kept in mind in performing this kind of risk-ranking analysis.

The categories of A3, A4, and A5 associate the severity of exposure to health outcomes classified as minor, moderate, and major. It is encouraging and very appropriate that exposure information is considered in the RVM. The likelihood of occurrence of an adverse health outcome (i.e., injury) is not only a function of extent and severity of exposure but potency of environmental release as well.

29 The four-step human health risk assessment paradigm originally developed by the National Research Council (NRC 1983) in 1983, and later augmented by the Presidential Commission on Risk Assessment and Risk Management in 1997 (PCRARM 1997a,b) has not been followed to characterize and compare risks associated with different activities at SRS

A chemical release with exposure concentrations exceeding 10 times the regulatory health-based limit but with high potency may cause more injury than another chemical with exposure concentration exceeding 50 times the limit, but with low potency. Hence, there may not be a linear relationship between exposure level and the potential for significant injury. Exposure level is very important but only one of the pieces of information used in assessing injury.

Assessment of likelihood of occurrence of single and multiple fatalities as a result of radioactive or hazardous material releases from Site operations is pertinent. However, there are a number of issues to be considered about the categories of A6 and A7. Those are: 1) use of a percentage of LD50 (a measure of acute risk of death) does not provide a measure of potential chronic adverse health effects for exposed human populations; and 2) acute fatality is one measure of harm, which has a low probability of occurrence. On the other hand, chronic toxicity associated with exposure to lower-levels of environmental pollutants could have greater public health impact. Hence, chronic toxicity should be a concern for public health protection and safety, depending on the size and vulnerability of target population. These categories address fatalities associated primarily with acute exposures resulting from mainly catastrophic events such as fire, explosion, and accidental release. Fatalities associated with diseases with long latency periods and lower levels of exposure, such as cancer, would be difficult to account for under this risk ranking system. Several public health consequence elements in the RVM need modification. Overlap of criteria must be avoided.

Recommendations: A number of categories should be added to understand the magnitude of the public health risk. The categorization from very high to low, based on years per incident, is appropriate for public safety evaluation but not for public risk evaluation. Someone getting exposed offsite to an agent with chronic toxicity is not likely to develop the disease for a long time. Site activity associated with lower-level exposures, as a result, will not receive a high score, and will be classified as a low-priority item. In reality, the probability for disease occurrence within the exposed population under those situations can be high depending upon the exposure characteristics, toxicity, and the size and susceptibility of the target population. The existing category system does not lend itself to account for those effects. Thus, we propose to add a new subcategory with the following definition: “Release involving any chemical carcinogens, teratogens, or sensitizers greater than health-based threshold levels.” This category could fit between current A3 and A4, becoming a new A4. The current A6 could blend with current A8 (which is not scored), to become a new scored A7.

Additional recommendations include:

1. Definition of A2 should be changed to “Release greater than allowable limits-Exposure < 0.1 rem or <10 X regulatory limit (RL)” to clarify and distinguish it from the other exposure-based subcategories of A3, A4, and A5;
2. the reference to injury (i.e., minor, moderate, and major) in A3, A4, and A5 should be eliminated (see Section 3.1).
3. The definitions of A3, A4, and A5, accordingly, should be “Release greater than allowable limits-Exposure > 0.1 rem or 10 x RL”, “Release greater than allowable limits-Exposure > 0.5 rem or 50 x RL”, and “Release greater than allowable limits-Exposure > 25 rem or 100 x RL”, respectively.
4. Since degree of exposure may not be directly related to severity of injury, it is more appropriate

to categorize severity of public health impact only by exposure;
5. fatality probability in A6 and A7 should not be based on whether exposure exceeds LD50 or not (see Section 3.1).
6. Additionally, because A7 is not evaluated within the RVM (no weighted score is assigned to A7), we propose that A6 and A7 subcategories should be merged together. A single category entitled “Fatality probability” should be created;
7. In addition to fatality probability, probability for adverse health effects (cancer and non-cancer) associated with low-level chemical exposure need to be examined.;
8. weighing of the likelihood of occurrence based on years per incident is likely to be skewed due to high scoring given to fatality. The likelihood of significant chronic disease occurrence, e.g., cancer, within the exposed population is overlooked, and will likely be ranked lower than fatality associated with acute exposure such as fire, explosion, and accidental release. The size and sensitivity (e.g., children, elderly) of the potentially exposed population should be considered in measures of public health and safety.

IV.2 Environmental Protection

Ecosystem functioning is critical both for environmental protection and for human health protection (as one of the receptors of the system, Burger 1999), thus should be considered as a critical driver for risk evaluations. As with some of the other categories, it would be useful for the process and for stakeholders to have an overall definition of Environmental Protection, and not just for the specific ranked subcategories within the criterion. This would make the real risk evaluations more transparent, since it would be clear whether the Environmental Protection category involves ecological protection, or ecological protection for the purposes of human health protection (see Suter 1998), or human health protection during remediation.

In the case of Environmental Protection, injuries and fatalities could relate to endangered or threatened species, species of special concern or of economic concern, or threatened or rare ecosystems. The following subcategories under the Environmental Protection category were assigned a weighted score in the RVM.

B1. Release above Normal limits
B2. Release Greater than Allowable Limits
B3. On-site Contamination > $10K
B4. On-site Contamination > $100K
B5. On-site Contamination > $1,000K
B6. Off-site Contamination
B7. Severe Multi-Media Contamination

It is laudable that the IPL process of risk ranking involves categories of different severity, with clear definitions of the consequences and examples of each subcategory. There is a reasonable progression from B1 involving a release, to B7 involving severe off-site, multi-media contamination. The progression from B3 to B5 is weighted by cost estimates. The attempt to rank consequences, with numerical values that lead to object rankings is also notable, as it introduces a formal method of evaluating risk in different work units.

There are two areas for improvement in the process with respect to subcategories of Environmental Protection:

- refinement of the categories; and
- consideration of temporal and spatial scales of ecological and environmental damage.

The subcategories under Environmental Protection involve release levels, on-site contamination, and off-site contamination. These latter subcategories are defined in part by costs incurred in the event of a release. These costs can include damages and remediation. Although the category is "environmental protection", there are no criteria that directly evaluate damage to the environment or destruction of ecosystems (and the organisms within them) or to the time for recovery, which are functionally-important aspects of protection of the environment. The cost of cleanup is a remediation measure, and does not take into account restoration of the environment. Thus, it may be compliance driven, and may not reflect ecological risk or environmental protection.

As mentioned above in Section III. 2, there is an implicit assumption that Environmental Protection involves protection of the environment so that public health is protected. This is the major difficulty and limitation with the Environmental Protection category.

It would be valuable to consider whether Environmental Protection is only human-related, or whether it does indeed apply to functioning ecosystems. If it includes the latter, then the categories under Environmental Protection, as iterated above, do not include an evaluation of the damage to ecosystems and their time to recovery, or the damage and injury to endangered, threatened, or rare species. Nor do the subcategories include the health of the ecosystem itself. If DOE desires, sub-categories within Environmental Protection might include measures of clean-up costs, damages to ecological services (both now included), as well as more traditional measures used in ecological risk assessment (Cook et al. 1999).

In addition, the current subcategories under Environmental Protection do not include temporal and spatial scales that relate to ecosystem function (and species health). The one-year risk scenario is inadequate to understand the real risks to systems that have organisms with different life histories (Burger and Gochfeld 1992).

The system of using Operable Units has been especially problematic in terms of ecological risk assessment because the work units bore no relationship to functioning ecosystems, such as watersheds, lake systems, or the Savannah River floodplain. SRS is to be commended for developing the Integrator Operable Unit, which attempts to develop remediation procedures for larger land blocks that are ecologically relevant. This will go a long way toward dealing with the spatial difficulties of the current work unit approach.

From an ecological perspective, the one-year time frame assumption for evaluating risk is reasonable if the question being asked is, what is the risk of not completing a particular work unit in the next year, and the delay will ONLY be one year. However, it is problematic from at least two viewpoints: a) Given inflation and continued pressure to proceed on other work units with higher priority, work units below the funding level may well stay below the funding level for several years, thus the real risk is for a longer time frame, and should be considered as such. Considerable attention should be devoted to determining what the time frames should be, and b) Ecological damage can involve both food chain effects and cascade effects. Thus, environmental damage may not be linear with time, but may increase disproportionately as contaminants move more quickly if they reach aquatic systems, and biomagnify if they move up the food chain (Eisler 1987, Fowler 1990, Fox 1994, Burger 1999). Finally, the ranking system, whereby the different subcategories are given different values (ranging from .001 to 1880), seems a bit arbitrary in that it is not intuitive how these were derived, or what effect these weightings have on the final ranking. This topic is considered further elsewhere in a more general sense.

Recommendations: While the current approach is a well-thought out, reasonable, and rational method for assessing risks and their consequences, there are improvements which would make the system more evaluative of protection of the environment. These include the immediate inclusion of the Integrator Operable Unit (IOU) in the IPL risk ranking, consideration of longer risk scenarios than just one year, and inclusion of measures of ecosystem damage, endangered species injury, and ecosystem recovery time. These are the considerations that ecologists would address when conducting ecological risk assessments. It is likely that the public at large also views environmental protection at least in part, as protecting ecosystems and their species, rather than just the resources needed by the public (or public health protection).

Examples of ecosystem measures that could be used as criteria would be: decline by some percentage in species diversity or reduction in food web complexity. Or, if a remediation were delayed for one year or more, would that delay require additional investment in restoration that could be prevented by immediate remediation. Further, the comments and examples all relate to either cleanup costs, or to the loss of public resources, and there is no mention of ecosystem integrity (Karr 1991, Karr and Chu 1999). {Many of the DOE lands, including SRS, have valuable ecosystems that bear protection for themselves (Brown 1998), not just for the ecological services and human health protection they provide}. In short, environmental restoration that encompasses only cleanup goals is not the same as ecological restoration where functioning ecosystems are restored (Burger, in press).

There are other environmental evaluation schemes that might provide some insight if these subcategories are considered further. For example, the National Research Council's volume on Ranking Hazardous Waste Sites provides a useful discussion of environmental evaluation. It stresses the importance of determining the current and future impacts on biotic receptors, refers to the non-human biological receptors, and provides comparisons of different ranking schemes (NRC 1994).

IV.3 Worker Health and Safety

Worker Health and Safety is a pivotal risk consideration since all activities involved in hazardous materials management, remediation, or restoration carry some potential for hazardous exposures as well as traumatic injuries to workers, and many activities carry a very high risk (Gochfeld 2000). Therefore it is laudable that Worker Health and Safety is given a highly weighted potential ranking. Workers, after all, are in daily and direct proximity to the hazardous environments while risk to the public is often delayed, distant, indirect, and theoretical. In addition, the Risk Value Matrix is a creative approach to including a variety of categories in risk management decisions. It recognizes that where preventive measures are in place to reduce risks of chemical or radiation exposure to workers, there remains a risk of traumatic injuries that require aggressive safety measures as well.

The following subcategories under the Worker Health and Safety category were assigned a weighted score in the RVM.

C1 Occupational injury requiring medical attention
C2 Skin contamination {with radionuclide}
C3 Lost time injury. Exposure > 5 rem
C4 Major occupational injury
C5 Exposure >25 rem or requiring hospitalization
C6 Single fatality, exposure > LD50
C7 Multiple fatalities, exposure > LD50

There is a clear progression from the relatively minor events in C1 and C2 to the fatalities in C6 and C7. There is also an attempt to blend the radiation hazards with the traumatic hazards. In the absence of a radiation accident, the main hazards encountered by remediation workers will involve physical trauma (e.g., vehicle accidents, crush injuries, electrocutions, falls), and most of these events will be similar to events encountered on jobs outside the DOE Complex.

In addition to varying by consequence, the 7 sub-categories vary in probability and predictability. C1 to C3 are readily estimated from existing safety data from the Site itself as well as from national statistics (although the validity of such statistics is always an issue due to concerns about under-reporting). C4 to C7 cannot be estimated statistically, but past events can be counted. Presumably the DOE's Lessons Learned approach to evaluating serious accidents, should reduce the future probability that such events will occur.

The Table accompanying the RVM provides examples that managers can use in estimating the consequences of deferred activities. The C1 events are likely to occur in a variety of occupations, and most are not directly related to the hazardous radionuclides or chemicals. These include vehicular accidents, falls, sprains, etc.

The example for C2 is not clearly different from C1. Similarly, C3 requiring emergency room attention is not strikingly different from C1, which requires medical attention. One might assume that the C1 category, originally, did "not require medical attention." Also the implication in C2 is that the minor skin or clothing contamination mentioned in C1 is "not reportable." The differences between C1 and C2 should be better explained.

For C4 to C7, it is stated that "This selection requires a credible scenario." We believe that this is equivalent to our earlier statement above, that C4 to C7 cannot readily be estimated from statistical sources.

The statement "Occupational Safety and Health Act (OSHA) probability of hazards causing death may be estimated from Site history" is not interpretable by us, and probably not by the managers who must score these categories.

Actual application of these subcategories to a specific work package can be challenging. Assuming that one could estimate the number of person-hours to accomplish the package, one could use accident/injury data to estimate the number of accidents that would occur. Since the injury data are usually not broken down more finely (e.g., teamsters, sheet metal, electrician, laborers, operating engineers, etc), it probably does not matter, that there may be no detailed breakdown of hours worked by each of the trades.

However, the rare events cannot easily be assigned to work packages, unless there are one or more packages in which the risk of such an injury is greatly increased.

A major concern relates to the "privatization" of remediation activities, with more and more of the hazardous materials handling being conducted by subcontract workforces which may not have the same level of protection afforded by the prime contractors. Thus the estimates of both probability and consequence made by a manager for a prime contractor may underestimate the risks to the subcontract workers (Gochfeld and Mohr 1998).

Recommendations: There are three areas of proposed methodological improvements that would make the system more transparent and useful in terms of worker health and safety. The three areas are categorized below:

1. Weighted Scoring**:** The likelihood of occurrence is treated in four categories in terms of the number of years per incidence. Very high probability events would be likely to occur in the one year during which the activity is suspended, while low probability events would be expected to occur once in every 100 to 1000 years.

The transition of one year to a one-to-ten year framework may be too abrupt, since under this paradigm, an event occurring only every two years would receive 1/10th the score of an annual event. The alternative, however, would require a more "precise" guess of the probability of the event happening, or a failure analysis that would model the probability of future failures (or events) based on past failure data. This is not a trivial task. Also, the scoring system appears to preferentially address acute risks, but not chronic work-related disorders. Chronic toxicity yields no cases until a number of years after first exposure and will get low ratings even with severe outcome. A modification of the weighted-scoring approach would enhance both concepts – future probability and chronic (as well as acute) potential outcomes.

2. Temporal window of consequences**:** The application of the IPL is based on potential risks which may occur if a particular work package is delayed for one year. This is important for setting annual budget priorities, but also creates a catch-22. An event which has a low annual probability, could always end up below the priority threshold, yet the cumulative risk of a project being deferred for five or ten years or longer could be very high. Such a risk is not recognized and captured by the current approach. Manager visibility has been limited by a short, annual budget-constrained horizon regarding project delays and may not be making the truly informed judgements that stakeholders expect.

This type of limitation also relates to the probability scores mentioned above. An event that is likely to happen once in two years is scored the same as an event that is likely to happen once in ten years.

3. Seductive precision of scores**:** At least in the Worker Health and Safety arena (and probably throughout the Risk Value Matrix) the person completing the matrix, will have only a crude estimate (often little more than a guess) of the appropriate weights. However, the resulting score will create the impression of being very precise.

This process is extremely vulnerable to individual values regarding risk. Persons who are risk aversive will give higher probabilities and higher consequences to a scenario than would a person who tends to be risk tolerant. The opportunity for optimistic (or pessimistic) biases to seriously influence the scores is significant.

Thus the documentation that accompanies each entry in the Risk Value Matrix can influence scores, may be open to bias, and therefore, should be reviewed by an independent manager. Moreover, it may be easier to complete the matrix if ranges of values, rather than precise scores, are used. This would give a more realistic picture of risk ranges associated with each deferred activity.

In conclusion, scoring low probability events with uncertain consequences is an appropriate way of prioritizing management options or work packages. However, the apparent precision of the resulting numbers may be seductive, and imply that the person completing the matrix for a particular package has more precise information than is possible in most cases. A useful modification may be to treat each entry as a range of values (i.e. include an uncertainty factor) rather than as a precise point estimate. Additional consideration should be made for chronic workplace risks – such as cancer and lung disease.

IV.4 Cost Effectiveness

The IPL includes a single scale that measures cost effectiveness:

H1 Minor increase in investment or operational savings
H2 Moderate increase in investment or operational savings
H3 High increase in investment or operational savings
H4 Extreme increase in investment or operational savings

This ordinal scale, or one like it, is consistent with the public policy principle that one should invest public revenues wisely. Furthermore, it is consistent with the growing political reality that even programs that invest in health and safety must have a clear economic rationale for investments. Whether it is the EPA, the DOD, or the DOE, leadership would be naive not to have a metric for managerial cost-effectiveness.

The execution of the metric in this case is somewhat less that what could be achieved. The numbers attached to the four groups range from less than $1 million annual costs (H1) to more than $25 million (H4). CRESP is not in a position to question the appropriateness of these dollar figures. However, these seem small (far less than one percent) in a budget of $1.5 billion. CRESP research on the salt waste tank problem and the proposed particle accelerator show very large contingency values (25-67%) in these projects. It would appear to us that there are opportunities to reduce costs beyond the numbers in the scale through cost efficient design and testing.

More important, the flip side of the scale is missing. The other side of the cost effectiveness is cost ineffectiveness. In this report, CRESP has noted that a long-term life cycle view is a critical step that needs to be added. This step is absolutely essential if DOE is to avoid short-term investments that seem efficient but in the long term are highly economically inefficient. It may be cost effective over the course of a single year to use a particular risk management engineering approach. But over the course of a decade or more that investment might lead to a public health or environmental problem that will require a massive investment to control. Likewise, an allocation that may seem cost inefficient in a single year may turn out to save a lot of money in the long run. For example, investing in five innovative technologies may seem inefficient in the short run, but if one or more prove to be effective, savings of billions could be realized in the long run.

Investment timing is another issue that the current year-to-year analysis neglects. CRESP's analysis of DOE EM missions shows that new DOE missions are conducted in a process that begins with little on-site investment while technology is being developed and designed and often pilot-tested off site (Greenberg et al., 1999, 2000). Then a lot is invested on site-during construction, and finally after construction is completed, costs and benefits reach an equilibrium, and slowly decline. Annual snapshots of cost efficiency cannot capture this dynamic sequence of activities.

Overall, while the accelerated cleanup plan devised by DOE headquarters a few years ago has not been implemented, the principle of investing money now to reduce the long-term mortgage without compromising health and the environment is well worth incorporating into the IPL process. Hence it is critical to have some sense of the life cycle costs as well as the annual costs of investments and to have both of these estimates in mind when making annual budget decisions. The current definition of managerial efficiency is a good start but is too narrow to measure what is needed.

IV.5 Public and Community Relations

Consideration of the perceptions and beliefs of local citizens is at the foundation of good risk assessment and management (PCRARM, 1997b). Therefore, public and community relations is an important factor to include in the risk prioritization process.

In the Risk Value Matrix, the category of Public and Community Relations reflects a continuum of community distress and resulting public response, somewhat defined as how much coverage the media reports. As defined, Public and Community Relations focuses on the response of the public about Site activities that could lead to potential delay or disruption of an activity. Thus, the worst case is one which Site activities stop because of community response. While the approach is rationale, it is narrow in scope. Other issues that reflect community concerns and impacts could be incorporated; for example, impact on environmental justice communities.

In early discussions with stakeholders (Nov. 8, 9, 1995, SRS-CAB Minutes), the social, cultural, and economic category originally identified in the prioritization process was collapsed with the public and community relations, upon suggestion from Site personnel and agreement with those stakeholders present. Collapsing the two categories of social, cultural, economic impacts with public and community relations creates one extremely broad concept that does not necessarily reflect the scope of stakeholder concerns and perceptions that could be considered in the risk prioritization process. The importance of including stakeholder perceptions in risk assessment, and management is well documented in the literature (Hance, Chess Sandman, 1991; Covello and Allen, 1988; Fischhoff, 1985). While it is true that examples citing newspaper coverage, discussion at community meetings, and involvement of special interest groups- subcategory examples provided in Attachment C– can reflect social, cultural, and economic concerns, other measures should also be considered.

The subcategories of the Risk Value Matrix of the Public and Community Relations category are:
G1 Minor Public Distress or Attention
G2 Spot Media Coverage
G3 Disregard of Civilian Recommendations
G4 Protracted Public Comments or Concerns

Two further subcategories (G5, Major Enforcement Actions and G6 Major Public Outcry) were identified in attachments B and C. The likelihood of these scenarios may be remote, but their addition would be more consistent with the severity represented in other categories. While the subcategory titles appear to generally represent a scale of increasing public concern, the subcategory titles do not reflect a logical sequence. For example, G2, Spot Media Coverage, is not a sub-category consistent with G3, Disregard of Civilian Recommendations.
The idea of viewing media coverage as negative is unnecessarily defensive and misses the opportunity to add positive community reactions to this scale which comes with new missions that create jobs, new programs that reduce risk, and so on. This is perhaps most evident in the ability of

the site to create jobs and reduce social injustice. A major element missing is impact on the surrounding region. The economic and social impacts of DOE investments at SRS on the area are arguably greater than at any DOE site. Among DOE sites, CRESP researchers have found that SRS, along with Hanford, Oak Ridge, and INEEL are the most dependent on DOE investments (Greenberg et al., 1999, 2000) DOE investments in these regions account for 10 to 20% of direct regional investments, with EM being a major component. Notably, CRESP researchers have found that the region surrounding SRS is perhaps the most vulnerable to changes in DOE budgets because the regional economy has been growing less rapidly than others and has structural limitations in access, education, and other features that make it difficult for it to compete with other regions. It may not be important on an annual basis to know how many jobs will be created by different DOE activities, but as part of the life cycle analysis it is important to be cognizant of the impact of alternative project designs on jobs, personal income, and unemployment rates.

Part of an impact analysis should focus on the how the Department's investments impact on different groups, especially disadvantaged groups. The Environmental Impact Statement (EIS) process requires environmental justice analyses. However, CRESP reviews of these for SRS and other DOE sites suggests that they are rather narrowly conceived. A map and/or data are compiled about places of low income and minority populations. But analysis is lacking about what DOE can do, if anything, to limit risk as well as encourage development of these areas. In fact, some of the annual budgetary considerations may include what the DOE could do in terms of hiring practices, business contracts, and job training to reduce the gap between the poor and others in the region. CRESP realizes that regional economic and social considerations cannot take precedence over DOE's primary missions. However, DOE should be aware of any possibility of being a good neighbor when it makes investment decisions.

Overall, the IPL definition of public and community relations is quite limited and eliminates the opportunity for the site to measure the economic and social benefits it brings.

Recommendations: The comment and example section of Public and Community Relations relies fairly heavily on the quantity of media coverage to assess the amount of public outcry, though other possible measures are suggested. CRESP research suggests (Waishwell and Lowrie, 1998) that media coverage of Site events is not an accurate measure of public concern. If the intent of this category is to incorporate social and economic considerations into public perceptions, the subcategories may need to be revised. Metrics and assessments of public perceptions exist (Williams, Greenberg, and Brown, 1999).

With regard to the one-year time frame, assessment of the appropriate value would be quite subjective and difficult to assess. This would require those using the matrix to consider community response if a work package were not performed for a single year. Additionally, the likelihood of occurrence by years per incidence is hard to conceptualize with this particular category.

While it may be difficult to create one category that adequately encompasses the potential impacts on social, economic, and cultural values, and also considers the effect of public outcry on Site activities, the following categories may be of use:

1. Consider different sub categories that better reflect the impact of public concern on the risk prioritization process and are more inclusive of social, economic and cultural impacts;
2. Estimate the economical and social impact of missions and options;
3. Develop a mechanism for periodically obtaining information on these subcategories; solicit stakeholder input for the best approach;
4. Evaluate the ability of Site personnel who utilize the matrix to assess specific values in a reliable way;
5. Provide more comprehensive examples to reflect social/cultural/economic impacts as well as public and community relations

Section V. Recommendations for Future Efforts: How to Integrate Non-discretionary Requirements into the System.

There is currently very little overlap between the priority issues identified by the three receptor-focused criteria (PHS, WR, E) and the issues identified when the discriminator is Compliance with Standards. The work packages that are viewed as most likely to generate strong regulatory action are not those which in any consistent way rank high in the Total Safety category. We have cited many reasons why the Total Safety Category may not currently be a good measure of receptor risks. But the discrepancy between what the Site scorers thought would concern regulators and what they thought were the most worrisome receptor risks is simply very great.

But, in fact, we suspect that the differences in perception between the Department of Energy and its regulators may be even more pronounced that those discrepancies.

CRESP spent considerable time reviewing one other source of information provided by the Site. DOE headquarters has for two years conducted a review of the EM program which uses a quite different set of metrics than those used by the Site. This system not only ranks activities in terms of their risks to receptors but also on the basis of their compliance status (see Attachment F). It explicitly distinguishes and ranks highest those activities which are needed for minimum safety and essential services needed to support those activities, then ranks activities which address significant risks, and those judged to involve regulatory requirements which DOE does not define as posing significant risks. Then three other categories for funding are ranked (activities for non-proliferation, for mortgage reduction and others that fulfill local community mandates). The methods used by Headquarters do not attempt to score multiple reasons for funding specific activities, and instead focus on which of the activities fall into the highest ranking criterion. But the Headquarters review also ranks activities in terms of their legal status – whether or not they are required by enforceable agreements with milestones or are essential to meet such enforceable requirements, etc. We find it very significant that in this review, the Headquarters group specifically cataloged more than two thirds of the activities to which it gave highest priority as those regulated not by any external regulator, but by DOE's Environment and Health regulations (DOE Orders). Indeed, CRESP is not convinced by the Site's own characterization of the results of the EM peer review study:

> "The team determined that regulatory compliance work, as well as the work required to maintain minimum safety and essential services made up the work-scope that DOE was obligated to request funding for, as required by Executive Order 12088. In FYOI, this amount was $1,281 million. DNFSB work, the Spent Nuclear Fuel program and much infrastructure work fell outside the Executive Order 12088 definition of the EM Peer Review. While there were some minor differences, the EM Peer Review results were similar to the SRS prioritization process and the IPL, thus validating the SRS prioritization process"

Any quick examination of the major differences that exist between the IPL Total Safety and Headquarters Peer Review ranks shown in Attachment G show why we doubt that that characterization is accurate. In fact, we find that there are very substantial differences between the rank order found in what the DOE Chief Financial Officer's Complex-wide EM Peer Review group selected, as compared to the SRS IPL rank listing. It is true that there is only a modest number of instances where Site priority choices did not make the Peer Review group's cut. But it is our observation that there are major differences between what the Peer Review group perceived to be most important to do as compared to what the Site is being told by its external regulators it must do, on the one hand, and what the Department views as most important on the other. A very close reading of Attachment G suggests that there is simply no basic agreement about **what** needs to be done **when**, except to maintain minimum safe conditions.

But there is an even more significant trend afoot in these several different rankings. The DNFSB clearly worries that the problem-solving activities about which it is concerned in 94-1 will not get done and expressly challenges the Site with its conclusions that the min-safe containment activities cannot stave off risks forever. In the report of the DOE Chief Financial Officer's Complex-wide EM Peer Review group (Attachment G) it is clear that, when cost is the denominator, only about half of the activities which regulatory agencies are requiring DOE to carry out are perceived by these Peer Reviewers actually to involve significant risks.

And we suspect that these discrepancies are a key reason that the SRS-DOE officials who requested this report asked CRESP to suggest methods to address non-discretionary expenditures. Many parties have legal authority over the EM cleanup process at SRS. Others have the authority to provide the resources and direct their use. But authority and power aside, it is clear that those who have diverse forms of responsibilities for activity at SRS have **quite fundamentally different definitions of what are the risks at the Site and what priorities ought to be established for expenditures of funds.** It is often suggested that the cause of these differences can be traced primarily to the different laws, regulations and policies from diverse federal and state agencies that are in play at the Site. By contrast, CRESP participants are not convinced that the EM problems at the Site have been sufficiently defined (and lined up coherently to relate to the activities being implemented at the Site) to enable most responsible parties and observers really to grasp the "whole." In the absence of such a clear picture of what are the Site's challenges, it is totally understandable that regulators go back to narrower regulatory approaches they know best.

Is it possible that it is precisely the current way of defining what is the "subject" of risk evaluation that obscures and blocks a pathway to a more holistic sense of what is the DOE cleanup challenge, how it can best begin to link stewardship concepts to completed work and optimally avoid duplicative activities where overlap is simply duplication, not layers of additional safety? We have suggested in this report that there is a way to take the current RPP and begin to attach its citizen-supported priorities to a much more robust way of sorting out what needs doing and what are the best ways to address what needs doing. It is noteworthy that regulators from both the State of South Carolina and EPA currently almost rave about the transformation of their understanding of ER problems at the Site, which has resulted from converting the hundreds of pages of raw data that used to be reported in tables into Geographic Information Systems (GIS) frameworks where Site location serves as the base for linking contamination and cleanup data to problems. CRESP suspects that converting the activity-based RPP into one which separates problems from the activities which they address would provide a platform for a similar transformation of the current mismatch between the several parties whose authorities and responsibilities give them different prisms through which to see and enforce what must be done at the Site. CRESP believes that the differences in perspective between the Department of Energy ands its regulating entities is actually very serious and likely to deteriorate unless a common base of understanding of what are the overall EM challenges that the Site faces becomes shared. The suggestions merely hinted at in this report would, when fleshed out in a more robust system, provide the basis for a shared understanding among all of these parties as to what the challenges at SRS actually are. At that point we believe there could begin to emerge the potential synchronization of requirements, prioritized to maximize both min-safe protection and effective use of resources actually targeted to achieve risk-reducing problem completion. And as the vision of what needs to be done became shared, there might well emerge more effective communication about ways of linking compliance requirements to achieve better organized Site-wide cleanup processes.

As noted in the Executive Summary, there is a Phase II of the work done in this report to move the risk information into a format where understanding would be possible. But the solution to the problem the DOE faces in terms of contradictory and inconsistent expectations will not end with providing somewhat better data and rankings. Facilitated discussion among the diverse parties involved, to forge a common understanding of the challenge, could, however, make a substantial difference if the revised RPP provided the information needed.

Section VI. Conclusions

CRESP has reviewed, at the request of DOE, the Risk Prioritization Process used by SRS. The primary focus of the review was on: 1) credibility, usefulness, effectiveness, and rationality of the Risk Value Matrix (RVM) and the process which generates the Integrated Priority List (IPL) process; 2) strength and limitations, and 3) recommendations for improvement, particularly in terms of linking risk to nondiscretionary mandates.

Our initial key findings were:

1) The SRS Risk Prioritization Process (RPP) is made up of many well-conceived pieces of a surprisingly coherent process which has been used with impressive consistency for five years. The judgments made in the process are consistently converted into quantitative evaluations, in accordance with commonly defined criteria, and hence they are quite transparent. Further, as the process was being developed, key elements of it were both defined and "weighted" in dialogue with the public, and both the process and its results are annually explained to and vetted with the public. Its very narrow focus is on risks to be incurred by delaying activities for a single year is inadequate, and needs to be expanded to longer time frames.

2) A revised/reformed process is needed to define a problem at baseline, including its (a) current and long term risks, (b) the major elements (tasks necessary to achieve both current minimum safe protection and desired risk reduction), and (c) a time-line with critical path assessment as to how the problem will be solved and whether other alternative approaches are still viable. It is fundamental to develop a ranking system that separates the location-specific problem from the activity being used to address the problem. Risks generated by problems (receptor-risks) are different from risks associated with when and how activities are implemented (business or program risks) and they should not be conflated. The category of Safeguards and Security may not fit this division and should be considered separately in a second phase review. Environmental impact (including ecosystems) is not adequately addressed and requires further consideration.

3) Either as part of the Risk Prioritization Process, or as linked directly to it, SRS needs a way of tracking both the stability of containment measures and progress in risk reduction from one year to the next, thus providing greater support to longer term managerial decision making.

4) SRS when evaluating each problem and the preferred activity to address the problem should also link the viable alternative activities and approaches. This will provide managers with a basis for decision making (and communication) in the face of required cost-cutting, delays, or delays in the identification or development of remediation technologies.

5) SRS should review and alter the specific metrics being applied in the RVM process to better incorporate concepts emerging in the current assessment and scientific literature.

Section VII. References

Brown. K. S. 1998. The great DOE land rush? Science 282: 616-617.

Burger, J. 1999. Environmental monitoring on Department of Energy lands: the need for a holistic plan. Strategic Environmental Management 1: 17 pgs.

Burger, J. in press. Integrating Environmental Restoration and Ecological Restoration: Long-term Stewardship at the Department of Energy. Environmental Management.

Burger, J. and M. Gochfeld. 1992. Temporal scales in Ecological Risk Assessment. Arch. Environ. Cont. Toxicol. 23:484-488.

Cook, R. B., G. W. Suter II., and E. R. Sain. 1999. Ecological risk assessment in a large river-reservoir: 1. Introduction and background. Environ. Tox. Chem. 18: 581-588.

Covello, V., Allen, F. (1988). Seven Cardinal Rules of Risk Communication. USEPA, Office of Policy Analysis, Washington, D.C.

CRESP Peer Review Committee. 1999. Peer Review of the US Department of Energy's use of risk in its prioritization process.

DOE. 1991. OSHA Training Requirements for Hazardous Waste Operators: Environmental Guidance. Washington DC. Department of Energy. Office of Environment, Safety and Health.

DOE. 1995. Handbook for Occupational Health and Safety During Hazardous Waste Activities. Washington DC: Department of Energy: Environmental Health/Environmental Management.

Eisler R. 1987. Mercury Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U. S. Fish and Wildlife Service: Biolog. Report 85 (#1.1).

EPA. 1986. Risk Assessment Guidelines. *Federal Register*. 51: 33992-34054. U.S. Environmental Protection Agency. September 24.

EPA. 1995. Policy for Risk Characterization. U.S. Environmental Protection Agency. March.

Fischhoff, B.(1985) Managing Risk Perceptions. Issues in Science and Technology.

Fowler S.W. 1990. Critical Review of Selected Heavy Metal and Chlorinated Hydrocarbon Concentrations in the Marine Environment. Mar. Environ. Res. 29:1-64.

Fox, G. A. 1994. Bioindicators as a measure of success for virtual elimination of persistent toxic substances. Int. Joint Comm. Windsor, Ontario.

Gochfeld, M. 2000. Hazardous waste management of DoE sites, pp. 605-624 in Protecting Workers at Hazardous Waste Sites (Martin WF, Gochfeld M, eds). Boston: Butterworth-Heinemann.

Gochfeld, M and Mohr S. 1998. A Registry of Subcontract Workers. Piscataway NJ: Consortium for Risk evaluation with Stakeholder Participation (CRESP) Report.

Greenberg, M., L. Solitare, M. Frisch, and K. Lowrie, Economic impact of accelerated cleanup on regions surrounding the U.S. DOE's major nuclear weapons sites, Risk Analysis, 19 (4), 1999, 635-647.

Greenberg, M., M. Frisch, L. Solitare and K. Lowrie, Downsizing US Department of Energy facilities: evaluating alternatives for the region surrounding the Savannah River nuclear weapons site region, Evaluation and Program Planning, 23, 2000, 255-265.

Hance, B., Chess, C., Sandman, P. (1991). Improving Dialogue with Communities: A Risk Communication Manual for Government.

Karr, J. R. 1991. Biological integrity: a long-neglected aspect of water resource management. *Ecol. Appl*., 1, 66-84.

Karr, J. R. and E. W. Chu. 1999. Restoring life in running waters: better biological monitoring. Island Press, Washington, D.C.

Martin, WF and Gochfeld, M. 2000. Protecting Personnel at Hazardous Waste Sites. Boston: Butterworth-Heinemann.

National Research Council. 1994. Ranking Hazardous-waste Sites for Remedial Action. National Academy Press. Washington DC.

National Research Council. 1983. Risk Assessment in Federal Government: Managing the Process. National Research Council.

PCRARM. 1997a. Framework for Environmental Health Risk management. Volume I. Presidential/Congressional Commission on Risk Assessment and Risk Management. Final Report.

PCRARM. 1997b. Risk Assessment and Risk Management in Regulatory Decision Making. Volume II. .Presidential/Congressional Commission on Risk Assessment and Risk Management. Final Report.

President. Executive Order. "Federal Compliance With Pollution Control Standards." Federal Register 43 (17 October1978): 47707.

Savannah River Site Citizens Advisory Board (SRS CAB). 1995a. SRS Citizens Advisory Board.

Risk Management and Future Use and Environmental Restoration and Waste Management Subcommittees. SRS FY 1998 Budget Prioritization Meeting. Graniteville, S.C. November 8. < http://www.srs.gov/general/people/srs-cab/nov8rmsub.html> (16 June 2000)

Savannah River Site Citizens Advisory Board (SRS CAB). 1995b. SRS Citizens Advisory Board. Risk Management and Future Use and Environmental Restoration and Waste Management Subcommittees. SRS FY 1998 Budget Prioritization Meeting. Graniteville, S.C. November 9. < http://www.srs.gov/general/people/srs-cab/nov9rmsub.html> (16 June 2000).

Savannah River Site Citizens Advisory Board (SRS CAB).1995c. SRS Citizens Advisory Board. Risk Management and Future Use and Environmental Restoration and Waste Management Subcommittees. SRS FY 1998 Budget Prioritization Meeting. Graniteville, S.C. November 14. < http://www.srs.gov/general/people/srs-cab/nov14rmsub.html> (16 June 2000).

Suter, G. W. 1998. Ecological risks are risks to what? Risk Policy Report. Feb.:38-40.

Waishwell, L., Lowrie, K. (1998). Reporting of risk in newspapers: Content analysis. Tenth Conference of the International Society for Environmental Epidemiology, the Eighth Conference of the International Society of Exposure Analysis. Boston, MA.

Williams, B., Greenberg, M., and Brown, S. (1999) Determinants of perceptions of trust, control and neighborhood quality among residents surrounding the Savannah Rive Site. Environment and Behavior 31(3).

Section VIII. List of Acronyms

ADS	Activity Data Sheets
CE	Cost Effectiveness
CM/BE	Cleanup Mission/ Business Efficiency
CRESP	Consortium for Risk Evaluation with Stakeholder Participation
CwS	Compliance with Standards
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
EIS	Environmental Impact Statement
EM	Environmental Management
EP	Environmental Protection
EPA	Environmental Protection Agency
FFA	Federal Facilities Agreement
GIS	Geographic Information System
INEEL	Idaho National Engineering and Environmental Laboratory
IPL	Integrated Priority List
MEP	Management Evaluation Process
MV	Mission Viability
NRC	National Research Council
PCR	Public and Community Relations
PH & S	Public Health and Safety
RDS	Risk Data Sheets
RPP	Risk Prioritization Process
RVM	Risk Value Matrix
S & C	Safeguards and Security
SRS	Savannah River Site
WHS	Worker Health and Safety

ATTACHMENTS

Attachment A: Savannah River Site's Own Description of the Risk Prioritization Process
Page 1 of 2

The Savannah River Site (SRS) has worked with DOE-HQ and its regulators and stakeholders to develop an acceptable and systematic risk-based prioritization process for its Environmental Management (EM) Program. This process, which is applied consistently across the SRS EM programs, has enabled SRS to better identify project needs and requirements and prioritize these projects in its annual budget formulation and execution since 1995. The SRS management team ultimately makes the final judgement on the prioritized activities. The process used at SRS is based on already existing prioritization models, with modifications suggested by the SRS stakeholders. This process outcome results in the Integrated Priority Listing (IPL) which is provided to DOE- HQ and to SRS stakeholders in order to communicate the planned work and associated funding requirements.

During the last decade, the SRS recognized the need to prioritize its work, as work requirements began exceeding funding projections. This recognition was followed by a request from DOE-HQ that each DOE field office implement a prioritized approach for its budget development and execution process. To meet both these needs, SRS developed a systematic and disciplined approach to prioritize its work. The SRS prioritization process, which continues to be used today, requires that all planned work activities be subjected to the same assessment in order to evaluate activities comparably. Ultimately, management must make the decisions on funding allocation; however SRS believes the model provides a strong framework upon which to make these difficult decisions. The SRS prioritization model is a weighted multi-attribute model based on an assessment of risk should a given activity be suspended for one year. The definition of risk employed is the product of consequence and probability.

The SRS process was based on models already in use at Rocky Flats and Oak Ridge. The resulting SRS model was evaluated extensively by stakeholders, which resulted in several modifications. The SRS stakeholders support the need for prioritizing work and have maintained active engagement in the annual prioritization process. Additionally, the SRS Citizens Advisory Board, through its annual review of the prioritization results, has formally recommended that SRS continue the use of the prioritization process. The final model, along with the annual results, has been shared with DOE-HQ, as well. The SRS prioritization model has become a fundamental component of the budget and execution process.

The Prioritization Process

In developing the SRS model, it was noted that various criteria (attributes) could be used to assess risk. After extensive collaboration with stakeholders, the model was finalized to include nine criteria. These nine criteria, which are Consistent with the DOE-HQ EM principles, include:

- Public Health and Safety
- Environmental Protection
- Worker Health and Safety

Attachment A: Savannah River Site's Own Description of the Risk Prioritization Process
Page 2 of 2

- Compliance with Standards
- Cleanup Mission/Business Efficiency
- Safeguards and Security
- Public and Community Relations
- Cost Effectiveness
- Mission Viability

Any single criterion or any grouping of these criteria can be used to develop a "ranking" of SRS work. However, due to the multiplicity of factors affecting resource allocation decisions, all the criteria and the hazards (or consequences) of an activity must be considered. Because consequences of varying significance are associated with each of these criteria, a weighting system must be attached to the criteria. In the SRS model, stakeholders provided significant input on the weighting of each of the criterion. Stakeholders weighted Safeguards and Security and Public Health and Safety most heavily, followed by Worker Health and Safety, Environmental Protection and Cleanup Mission/Business Efficiency. The remaining criteria are weighted less significantly.

To sufficiently define risk, both the consequence and probability of a consequence must be determined. This recognized two-dimensional approach is taken with the SRS prioritization model. For example, a waste unit that has low levels of contamination would pose a low hazard if workers were exposed to the contamination only a few times during their career. However, if workers were exposed to the same low level of contamination daily for many years, the risk for those workers is higher, due to the frequency of their exposure. Likewise, a tank containing highly toxic materials may pose a very high hazard to human health and the safety, but if there is low probability of anyone ever being exposed to that material, the risk to human health and safety is low.

The SRS prioritization model includes the nine criteria listed above. This goes beyond the common definition of risk, which includes protecting human health and safety and the environment. SRS has adopted this more comprehensive and integrated approach due to the complex factors that influence decision-making. However, it is important to note that with the weightings for Public Health and Safety, Environmental Protection, Worker Health and Safety and Safeguards and Security, the SRS prioritization process has the potential to be more heavily influenced by these-criteria.

Attachment B: Risk Value Matrix
Page 1 of 2

Attachment B: Risk Value Matrix
Page 2 of 2

Attachment C: Risk Value Matrix: Definitions, Consequence, Comments and Examples
Page 1 of 8

Attachment C: Risk Value Matrix: Definitions, Consequence, Comments and Examples
Page 2 of 8

Attachment C: Risk Value Matrix: Definitions, Consequence, Comments and Examples
Page 3 of 8

Attachment C: Risk Value Matrix: Definitions, Consequence, Comments and Examples
Page 4 of 8

Attachment C: Risk Value Matrix: Definitions, Consequence, Comments and Examples
Page 5 of 8

Attachment C: Risk Value Matrix: Definitions, Consequence, Comments and Examples
Page 6 of 8

Attachment C: Risk Value Matrix: Definitions, Consequence, Comments and Examples
Page 7 of 8

Attachment C: Risk Value Matrix: Definitions, Consequence, Comments and Examples
Page 8 of 8

Attachment D: IPL Sort
Page 1 of 5

Attachment D: IPL Sort
Page 2 of 5

Attachment D: IPL Sort
Page 3 of 5

Attachment D: IPL Sort
Page 4 of 5

Attachment D: IPL Sort
Page 5 of 5

Attachment E: SRS FY 2001 Integrated Priority List ($K – February 02, 2000)

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 1 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 2 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 3 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 4 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 5 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 6 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 7 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 8 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 9 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 10 of 11

Attachment F: Savannah River FY00 to FY01 Budget Comparison Dollar by EM Categories
Page 11 of 11

Attachment G: Rank Comparison
Page 1 of 6

Attachment G: Rank Comparison
Page 2 of 6

Attachment G: Rank Comparison
Page 3 of 6

Attachment G: Rank Comparison
Page 4 of 6

Attachment G: Rank Comparison
Page 5 of 6

Attachment G: Rank Comparison
Page 6 of 6

COMMENTARY: CRESP PEER REVIEW COMMITTEE

INTRODUCTION

This review of the June 1, 2000, draft report by Powers, Burger, Erdal, et al., entitled "The Risk Prioritization Process as It Shapes the SRS Integrated Priority List: An Initial Review of the SRS Model" was performed by the Peer Review Committee of the Consortium for Risk Evaluation with Stakeholder Participation (CRESP), at the request of the Consortium's Management Board. In conducting the review, the members of the Committee (Table 1) operated independently of all other CRESP, SRS, or DOE-related activities, in accordance with the Committee's standard operating procedures. The principal findings and conclusions resulting from the Committee's review are presented in the following.

GENERAL COMMENTS

The report by Powers et al represents a thoughtful evaluation of the process used for prioritizing environmental management activities at the Savannah River Site. The report recognizes the strengths in the SRS process, as reflected in its incorporation of relevant ranking criteria, its coherent method for deriving an integrated priority list, and its provision for regular public input into the process. Thus, in spite of the fact the process is also judged to suffer from the significant limitations noted below, the report advocates its continued use at the site, pending efforts to correct the deficiencies.

The report notes that the effectiveness of the existing process is seriously limited by:
1) its failure to identify the specific environmental problem to which each management activity is addressed and to define how that activity contributes to the ultimate solution of the problem; 2) its failure to evaluate whether an alternative risk management strategy might address the problem more effectively, especially in the event of a shortage of funds or other cause of delay; 3)its failure to include an evaluation of the risks that may be associated with a given risk management activity itself; 4)its failure to evaluate risks over a time horizon longer than a single budget year; 5)its failure to include methods for tracking progress from year to year and for reaping the benefits from the lessons to be learned thereby; 6) its failure to provide appropriately for the scoring of long-term health and ecological impacts in its risk-weighting system; and 7) its failure to be adequately understandable and acceptable to all concerned parties.

The report recognizes that the changes required to address these limitations need to be developed with care and with adequate involvement of the relevant regulatory authorities, the public, and other stakeholders. Hence, efforts to incorporate the recommended changes into a risk-based prioritization process that would be understandable and acceptable to all concerned parties are judged to lie outside the limited scope if the present short-term review. The report suggests, therefore, that the present review should be seen as "Phase 1"of a continuing effort, in which the evaluation of steps to incorporate the recommended changes into the SRS process might follow at a subsequent stage.

The report is to be commended for presenting an insightful critique of the SRS risk prioritization process and for providing constructive recommendations for improving the process. In view of the difficulties that are entailed in developing objective systems for prioritizing the risks associated with environmental problems as complex as those at SRS, the report is appropriately presented by its authors as Phase 1 of a continuing effort. Viewed in this context, the report's criticisms of the prioritization process appear to be well founded, and its recommendations for improving the process appear to merit implementation, with the expectation that they will be developed further and refined progressively with use.

The report is well organized, but its language is awkward and difficult to follow in places. Careful editing for typographical and grammatical errors is also needed to improve its readability. In addition, many references are missing, and although most acronyms are defined when used for the first time in the report, the inclusion of a Glossary would be helpful. In the remarks that follow, no attempt is made to offer detailed editorial suggestions, which have been provided elsewhere.

SPECIFIC COMMENTS

Executive Summary

This section of the report summarizes the key findings and recommendations reasonably well, but it needs to be revised to reflect more adequately the criticisms developed in the body of the report, as noted below in comments on the Conclusions Section.

Introduction

Page 9, 1st full paragraph: it is not clear from this paragraph whether the report deals with "methods to address non-discretionary expenditures and/or mandates in the context of IPL", a topic which is listed in the preceding paragraph as one of the main issues to be addressed.

Section 1. The Risk Prioritization Process, Risk Value Matrix and Integrated Priority List

This section of the report provides a concise description of the various elements in the SRS risk prioritization process and a thoughtful commentary on how the elements relate to one another. However, the comparison of the SRS Risk Prioritization Process to a puzzle in which all the pieces fit together to constitute a perfect whole (Figure 2) does not seem to be an appropriate analogy, given the gaps, misfits, and missing components noted elsewhere in the report.

Section II. Analysis of the Rankings and Scores that emerge from the current Risk Value Matrix

This section of the report finds that the scores typically assigned to health and environmental risks are substantially lower than those assigned to cost-effectiveness, compliance with standards, business efficiency, and public relations. This finding is interpreted to signify that the system guides decision making adequately only in those situations where short-term suspension of an activity would pose a clear threat to min-safe conditions, and that the system fails to provide any assurance against the existence of other, comparably high-risk situations that may remain to be addressed. These are important inferences, and although the basis for them is well documented, the reasons for the underlying discrepancies in the scoring process are not clearly defined.

Section III. The Major Additions Needed for Robust RPP

This section of the report presents the cogent argument that the SRS prioritization process suffers from two fundamental weaknesses; namely, 1) its failure to score risks in relation to the environmental problems that pose the risks, rather than in relation to the potential impacts that may result from delaying relevant risk-management activities; and 2) its failure to evaluate the potential impact of delaying a given risk-management activity for more than a single budget year. To correct these deficiencies, the report recommends the following basic changes in the process: 1) the process should define for the entire life cycle of each risk-management project at the Site: a) the risk posed by the specific environmental problem to which the project is addressed, b) the risk that may be associated with the risk-management activity itself, and c) the degree of risk reduction that the project is intended ultimately to achieve; 2) the process should include a method for tracking the yearly progress that is made in addressing the risks, and for incorporating the data on successes and failures into prioritization of the relevant risk-management activities; and 3) the process should incorporate or reference alternative approaches for addressing the problems in question, so that the comparative merits of alternative approaches can be evaluated readily when needed.

Section IV. Interim Steps to Reform the Existing Process: Rectifying Problems with the Criteria and the RVM that Explicates Them

This section of the report discusses limitations in the Risk Value Matrix and the changes in its risk-scoring criteria that would be needed to correct the deficiencies. The points appear to be well taken, and they are generally well presented.

Section V. Recommendations for Future Efforts: How to Integrate Non-discretionary Requirements into the System

This section of the report discusses the steps needed to correct the mismatch between the priorities that are typically assigned to environmental management activities on the basis of the relevant health or environmental risks and those which are assigned on the basis of regulatory or legal requirements. It suggests that the changes recommended in previous sections of the report will be required to resolve the differences in priorities that exist among regulators, site managers, headquarters personnel, community members, and others whose interests and responsibilities at the Site diverge. Such changes are inferred to be necessary in order to enable the regulatory authorities and other concerned parties to share a common view the environmental problems in their entirety, and thus to arrive at a shared understanding of the risk management measures that are called for. These recommendations appear to be well justified, based on the findings presented in preceding sections of the report, and they are presented clearly and well.

Section VI. Conclusions

This section of the report summarizes the principal conclusions emerging from evaluation of the SRS prioritization process. The remarks here about deficiencies in the process, however, do not appear fully consistent with remarks made elsewhere in the report, as exemplified in the following:

Page 5, footnote 4: "…the elements of the current system do not appear to be linked in ways that allow ready review of what judgements were made about risks of specific projects and why."

Page 6, footnote 5: "… CRESP personnel have found the process of actually understanding what the RPP does and does not address to be slow and arduous. Several of these CRESP participants are national experts in evaluating risk ranking systems for environmental activities and yet have struggled to interpret what would appear to be simple components of this system".

Page 25, full paragraph, line 4: "It (the pattern of scores assigned in the Risk Value Matrix) could support conclusions generally about risks being addressed by the EM program: either that the RVM is not capturing anything very significant about the longer-term risks or that there are, in fact, few serious risks associated with any EM problems at the Site. We find that analysis inconsistent with our own discussions with SRS staff personnel and our knowledge of what would occur if materials at the site were not effectively managed".

Page 26, line 12: "…this environmental protection criterion's matrix really is not made up of a coherent set of scenarios by which to evaluate the impact on the environment of SRS problems and may not be reflecting anything of significance at all about the environmental impacts or the ecosystem's vulnerabilities associated with either the specific problem the activity is addressing and certainly not the injuries likely to result from cleanup".

Page 27, 2nd paragraph, line 12: "One is fairly forced to the conclusion that the current system is not working as a guide to managerial decision making, except in situations where short-term suspension of activity would threaten min-safe conditions."

Page 51, 3rd paragraph: "…it is clear that those who have diverse forms of responsibilities for activity at SRS have quite fundamentally different definitions of what are the risks at the Site and what priorities ought to be established for expenditures of funds."

To address the inconsistencies noted, the relevant paragraphs in the Conclusions Section need to be revised to reflect the many pages of well-developed criticisms that are set forth in the body of the report.

Table 1. Members of the CRESP Peer Review Committee

Ahearne, John F., Ph.D., Director, the Sigma Xi Center
Bingham, Eula, Ph.D., Professor of Environmental Health, University of Cincinnati
Carter, Melvin W., Ph.D., International Radiation Protection Consultant
Cooper, William, Ph.D., Professor of Environmental Toxicology, Michigan State University
Fairhurst, Charles, Ph.D, Professor of Civil & Mineral Engineering, Univ. of Minnesota
Jasanoff, Sheila, Ph.D., Professor of Science & Public Policy, Harvard University
Jim, Russell, Manager, Environmental Restoration/Waste Management Program, Yakima Nation
Kimbrough, Renate D., M.D, Environmental & Occupational Health Consultant
Lippmann, Morton, Ph.D., Professor of Environmental Medicine, NYU School of Medicine
Ringen, Knut, Dr.P.H., Wash. State Building and Construction Trades Council, Seattle, WA
Russell, Milton, Ph.D., Emeritus Professor of Economics, University of Tennessee
Tano, Mervyn, General Counsel, International Institute for Indigenous Resource Mgt.
Upton, Arthur C., M.D., Professor of Environmental & Community Medicine, UMDNJ*
Walker, Bailus Jr., Ph.D., M.P.H., Professor of Envir. & Occup. Medicine, Howard Univ.
Zeise, Lauren, Ph.D., California Environmental Protection Agency

*Chairman of Committee