COMPARATIVE RISK ANALYSIS IN THE DEPARTMENT OF ENERGY

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I. INTRODUCTION

I am delighted to be here to give you my views on how Comparative Risk and Public Policy fit together, and more specifically how the Department of Energy has developed some approaches in using risk analysis to formulate public policy. Our Departmental missions encompass national security; environmental quality; science and technology; and energy resources. Over the past three years I have been directly involved with two of these missions: (1) environmental quality and (2) national security. I would like to discuss with you how comparative risk analysis has been one of the tools the Department has used to define and achieve our goals of keeping nuclear materials safe and secure, and reducing urgent risks in the nuclear weapons complex. In our view, comparative risk analysis has helped us set priorities, select alternatives, allocate resources, and measure progress.

I would like to describe the road we've taken in risk management at the Department of Energy over the past three years, review with you what obstacles— both conceptual and institutional—we have encountered, comment on where we are headed, and discuss how our risk analysis approaches can be broadly applied to achieve our national goal for sustainable development.

A. *Risk Issues in the Department of Energy: Why We Need Risk Analysis*

The Department of Energy faces a panoply of risks, many of which eclipse your "garden variety" risks of typical Superfund and RCRA sites. After 45 years of nuclear weapons production testing and research, we have an extraordinary legacy of environmental challenges and responsibilities, including:

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- 3,700 contaminated sites in 34 States and Territories
- Over 1 million gallons of radioactive and mixed waste in 332 tanks
- Over 600 billion gallons of contaminated groundwater
- Almost 3000 tons of spent nuclear fuel, some of which has been in pools for over 30 years and is now corroding
- Decontaminating and decommissioning 1,200 facilities, which are contaminated with radioactive and other hazardous materials
- 26 metric tons of plutonium scraps and residues which need to be stabilized and safeguarded -- enough to make several thousand thermonuclear warheads -- while protecting the safety and health of our workers and the public in communities around our sites.

But the Department's challenges are not just environmental. While the end of the Cold War brought about dramatic change, nuclear weapons remain a significant threat to the security of our Nation and to the future of our children. The security challenges now come from the spread of nuclear materials, technology, and expertise to those such as terrorist groups and rogue nations who seek to use them to exert political power. This Administration and the Department of Energy are playing a crucial role in reducing this nuclear danger and making the world safer through its national security programs.

Allow me to put "risk" in perspective. The Department is ensuring a safe and reliable nuclear stockpile without nuclear testing. We are working internationally to reduce the global nuclear threat by keeping nuclear bomb fuel out of the reach of hostile nations. The Clinton Administration has demonstrated real leadership in moving the world towards a Comprehensive Test Ban Treaty—an American objective since the 1950's. The Department of Energy has supported and enabled the U.S. moratorium on nuclear testing. In sum, reducing the danger posed by proliferation is a vital national security mission for the United States. The Department is using all its resources to detect and respond to the threat generated by nuclear smuggling. Our work is helping guard against the possibility that an Oklahoma City or World Trade Center bombing in the future could involve a terrorist's nuclear device.

You can see that these are real world issues. Managing these risks is not an academic exercise, and we have little margin of error to

get lost in 'theoretical' exercises. But while these challenges are daunting, they offer great opportunities to public policy makers for marshaling all our skills and talents to reduce the nuclear danger, ensure national security, and protect the environment. There are tremendous opportunities in the government as a whole and in the Department of Energy in particular to use comparative risk analysis as a tool to set priorities, select alternatives, allocate resources, and measure progress, with the ultimate goal, set by President Clinton and Vice President Gore, to develop and deploy technologies to protect the environment while sustaining economic growth.

II. RISK MANAGEMENT IN ENVIRONMENTAL MANAGEMENT

Let me share with you how we, in practice, have implemented risk management in the Office of Environmental Management over the past 3 years. When the Clinton Administration arrived in 1993, our first strategic goal was to address urgent risks. The magnitude of environmental problems facing the Department has made this a daunting, but not impossible, task. In 1993, we had no firm idea of what the risks were to the public from the extensive contamination and operations of decades of nuclear weapons production. Enormous quantities of radioactive, hazardous and mixed wastes exist in the soil, groundwater, tens of thousands of tanks and canisters, even in ducts and pipes in our buildings, all in an area that is larger than Rhode Island, Delaware, and Washington D.C. combined. To regulate these risks, no less than ten major environmental statutes, from the 1946 Atomic Energy Act to the 1992 Federal Facilities Compliance Act, apply to the Department of Energy. Further regulation comes from over 100 binding agreements with the states and EPA, signed by the Department since 1980, over 70 of which remain in effect. As you might gather, there is no one, single consistent framework for considering in an integrated fashion the multiple types of risks and hazards in the nuclear weapons complex. Our strategy was to identify the highest hazards and risks in the complex, and in so doing, help us establish priorities for action within this vast system. In reality, we wanted to use risk as a tool to probe the Office of Environmental Management program.

In 1993, we requested that the National Academy of Sciences determine whether a risk-based approach to our program would be feasible and desirable. This was not an insignificant step. It was controversial for many reasons, not the least of which was approaching an outside organization to determine whether such an analysis was fea-

sible. The result was a watershed document: the National Research Council's Report, *Building Consensus*.[1] It described the four components of the risk process as risk assessment; risk management; public participation; and, policy setting and decision-making. *Building Consensus* came to several important conclusions: 1) risk assessment must be iterative so that the issues stay current; 2) the Nuclear Regulatory Commission agreed with our contention that *who* does the risk assessment matters; and 3) credibility is a critical element in both conducting the assessment of risk and reviewing such assessment. The primary effect of this report was a significant increase of public participation in the risk management and in setting priorities at Department of Energy sites. This Environmental Management experiment was endorsed in the first draft of the President's Commission on Risk.

Another milestone on our road to risk management was the Department's adoption of a set of risk principles in 1995. The Department of Energy is one of the first government agencies to adopt this set of risk principles which provide a general framework for risk analysis which includes risk assessment, risk management, risk communication, and priority setting. They mirror *Building Consensus*'s framework. These principles are aspirational rather than prescriptive. Their application requires flexibility and practical judgement. The practice of risk assessment is rapidly changing and its use is a function of several factors, including legal mandates and available resources. The principles are intended to be used as a point of departure for future efforts.

Another force which shaped our risk policy has been Congressional interest. Senator Moynihan's bill in the early 1990's on comparative risk was the first serious piece of legislation that called for comparative risk in a formal way. The Senate Appropriations Committee in 1993 requested a report from Environmental Management to establish priorities among competing clean-up requirements and to evaluate the risks to pubic health and safety posed by conditions at weapons complex facilities that are governed by compliance agreements. Also, the risk-cost benefit discussions that were the start of the regulatory reform efforts in the 103rd Congress, as you all know, really became vigorous in the 104th Congress.

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1. EDITOR'S NOTE: *See* COMMITTEE TO REVIEW RISK MANAGEMENT IN DOE'S ENVIRONMENTAL REMEDIATION PROGRAM, NATIONAL RESEARCH COUNCIL, BUILDING CONSENSUS THROUGH RISK ASSESSMENT AND MANAGEMENT OF THE DEPARTMENT OF ENERGY'S ENVIRONMENTAL REMEDIATION PROGRAM (1994).

DOE's Risk Report to Congress was the first attempt on a site-by-site basis to identify the spectrum of risks —public, worker, environment— and to qualitatively link these risks to compliance agreements, and to the proposed costs of activities. Our evaluation indicated that the compliance agreements were addressing our most important risks. Moreover, without containment and limited public access, the Department's inventory of hazardous and radioactive materials, sites, and facilities would pose much higher risks.

The Environmental Management Advisory Board, one representation of our outside public, recommended tying the analysis of risk activities in a comprehensive way to the annual budget cycle for the Environmental Management program. The Board also recommended aggressively seeking both the internal experience of the Department and a critical independent review both during and after this budget-risk process.

Let me take a moment to detail some of the features of Environmental Management's risk analysis effort. It was comprehensive across all Environmental Management activities, which collectively carry a $6 billion price tag. It categorized activities with regard to risks to the public, the workers, and the environment, as well as the extent of compliance with existing environmental and departmental regulations, and it linked it to the yearly cost of each activity. Categories of activities were then evaluated and analyzed, in terms of both the severity of impacts and the likelihood of occurrence, to arrive at the three levels of risk: High, Medium, and Low. In sum, it was a massive comparative risk analysis, crossing receptors (public, workers, environment), media, and time (past, present, future activities). In setting our sights on such a ground breaking task, we had to overcome a number of obstacles, which I'd like to share with you now.

A. *What Were the Obstacles and What Are the Current Obstacles for Such an Analysis?*

One of the major obstacles was how to bring citizens into the process in a meaningful way. Prior to 1993, the Department was operating under the principles of the Cold War and public participation was not actively pursued. When the Cold War era ended, the Department started to break down the walls of secrecy that had endured for 50 years. This Administration has embraced the openness initiative and has actively sought stakeholder participation.

As part of our commitment to opening up the Department, I requested authority from the Office of Management and Budget to allow public participation in our budget formulation process— something never done before. It was our belief, with the Administration, that unless the taxpayer understands how the money is being spent and what issues are being addressed, the credibility of the decisions of the Office of Environmental Management could not be improved. This process allowed citizens the opportunity for real time input into the decision process. However, this process was not achieved without significant difficulties for both internal and external participants, mainly because of the limited time period that the annual budget process allows for gathering, processing, and evaluating information that can then be used to prioritize activities and make decisions. Each participant wanted more time to complete evaluations, but as you know, the process to develop the federal annual budget is very prescriptive and the time slots for submission are very rigid. However, opening the process up takes some of the mystique out of how the activities are prioritized and how each sites' budget is developed.

Tying the risk information to the annual budget cycle allowed both citizens and the Department to evaluate the activities and their associated risks, and showed how risk information could potentially be used in priority-setting. The downside, however, was the inflexible budget cycle.

Secondly, because of the link to the budget, the activities evaluated for risk were those developed to allow budgeting for one-year increments. Thus, the scope of the projects to be analyzed was not consistent across the country, or in some cases, across a site, especially since the scope of the analysis did not reflect the full project through which the Department was attempting to address risk. There was no way to link total risk with total costs of a project that had specific start and completion dates defined.

We learned two important lessons in doing our Risk Report and subsequent risk evaluations. One is that without senior level management support, cross-cutting programs and analyses are not successful. Such programs require nurturing in order to successfully facilitate the coherent, protective change from a rigid compliance-based program to an open program that is based on establishing priorities with citizens and regulators, and that reduces risk to the public, the workers, and the environment in a cost effective manner.

The second is that credible external review, including peer-review, is essential. In addition to the reviews by the National

Academy of Sciences, we encouraged review by the Environmental Management Advisory Board, both for process and direction, and we accepted and implemented every one of the resolutions concerning risk passed by the Board. We have used outside institutions as one mechanism to gain credibility for our technical assessments so that they are acceptable to the scientific and public health communities and the affected public. Chuck Powers, a representative from one of those institutions, the Consortium for Risk Evaluation with Stakeholder Participation (CRESP), is here with us today. We have used this institution, not only to perform research in risk analysis, but to undertake peer-review of the Department's risk evaluations as well.

B. *Where Are We Today and What Is the Path Forward to Overcome these Obstacles?*

Thus far, I've shared with you the whys and wherefores of risk analysis in response to specific needs and opportunities within the Department of Energy. But risk analysis has value as a public policy tool far beyond the needs of just one program or one federal agency. Comparative risk analysis can and should be integrated with our national policy goals of protecting the environment while growing our economy sustainably—what many people refer to as sustainable development.

What path are we taking in the Department to overcome these obstacles? We will continue to enhance the process of risk evaluation so that it is consistent across the complex and we can examine all of the risks at one time -- instead of on a chemical by chemical basis or only by worker, public, or environment segments -- so that the "whole risk picture" is evaluated at the site and the option selected reduces the risk to the lowest acceptable level at the best price to the taxpayer.

We will continue to champion processes and procedures that enhance public participation—all interested parties need to be brought in early in the decision-making process so that they can influence and be part of the solution .

We need to ensure credible, continued attention to peer-review of the processes and procedures used for risk analysis by independent groups with credibility to citizens and the public as a whole.

We will need to define the scope of the analysis to enable us to look at the life cycle risks rather than looking at an annual risk or a "snapshot-in-time" picture. Once the project is defined, we can measure our progress toward achieving our goal for the project. It

also allows us to be accountable. This is an ongoing effort in Environmental Management now, as projects are being defined under the Ten Year Plan Initiative.

We must continue to review our decisions and options in an iterative manner and incorporate new information or scientific breakthroughs and new technologies to evaluate alternative scenarios, and perhaps revise our decision.

C. *Examples of How These Approaches Have Worked*

We have learned that citizen participation is an essential part of our decision-making process. Besides enhancing credibility and accountability, it has proven to be economical and effective. DOE's Fernald Site in Ohio is a large industrial site comparable in scale to Ford Motor Company's River Rouge plant. The Fernald Citizens Task Force examined and analyzed conditions and risks at the site, and concluded that different parts of the site would be suitable for different future uses. They made recommendations as to the site's future land use, cleanup levels, on and off-site waste disposal locations, and cleanup priorities. As a result of the collaborative process with the site contractor and the Department, recommendations were made which will save time in completing the cleanup with an estimated one billion dollars in cost savings over the life of the project.

The second example I want to describe does not have final resolution as yet, but it illustrates why it is so important to have an iterative process to review options and alternatives and incorporate new science and technology where appropriate. As I have mentioned, the Department has large volumes of high-level waste stored in several hundred tanks. This tank waste contains many substances and takes the form of sludges, solids, alkaline or acidic solutions and slurry phases. The waste volumes contain radioactive cesium and strontium, difficult substances to remove from solution. This mix makes it difficult to reduce the volume of the liquid high-level waste, which has major implications for the overall costs of managing risks and this waste.

While researchers supported by the department were developing an ion exchange material called crystalline silicotitanate (CST) with application as a catalyst for coal liquification, CST was shown to have a large affinity for cesium in the presence of high sodium concentrations. A demonstration selectively removed the cesium and strontium from liquid high-level waste, thereby reducing the amount of high-level waste requiring special disposal. The remaining low-level

waste volumes were separated for more routine treatment and disposal. In addition, the binding was irreversible, and therefore, the CST with bound cesium and strontium could be considered as a final waste form.

Such issues have major program implications, as well as regulatory implications. While all of these issues have not been sorted out yet, it has the potential of reducing risks by reducing both the volume of the waste and the mobility of the contaminants, and providing significant savings in treatment and disposal costs of high-level waste. We believe that use of risk analysis to compare such alternatives for impact on human health and the environment is a powerful tool. This is true especially when risk analysis is linked to the costs of the alternatives, and will assist decision makers in evaluating all of the options available for treating the waste.

Thus the risk paradigm has the potential for providing the path forward not only for Environmental Management and related programs with radioactive and chemical contamination of the environment, but in its broadest sense, for sustainable development in the Twenty-First Century. We have the means within our grasp to use the environmental technologies we are developing and have used to make the bridge to sustainable development across all programs in DOE.

III. CONCLUSION

Today, I've described for you how the Department of Energy, particularly in its Environmental Management program, has used comparative risk analysis to define and achieve our goals of keeping nuclear materials safe and secure, and to reduce urgent risks at our weapons production sites across the country. Comparative risk analysis has been and will continue to be a valuable tool in setting priorities, selecting alternatives, allocating resources, and measuring progress. It is a tool that can and should be applied to a wide range of programs and activities.

Comparative risk analysis is a valuable asset in achieving the right kind of public policy making. As Edmund Burke said in his *Reflections on the Revolution in France*, "Government is a contrivance of human wisdom to provide for human wants. Men have a right that these wants should be provided for by this wisdom."[2] It was also

2. EDITOR'S NOTE: *See* EDMUND BURKE, REFLECTIONS ON THE REVOLUTION IN FRANCE 66 (F.G. Selby ed., MacMillan and Co. 1924).

Edmund Burke who gave us the saying that "politics is the art of compromise."[3] I would submit to you that comparative risk analysis enables us to achieve "informed compromise," to the greater benefit of each and every one of us, and our children and grandchildren.

3. EDITOR'S NOTE: Probably a derivation of "All government … is founded on compromise and barter." EDMUND BURKE, Speech on Conciliation with America, 22 March, 1775, *in* 3 THE WRITINGS AND SPEECHES OF EDMUND BURKE 105, 157 (W.M. Elofson & John A. Woods eds., 1996).