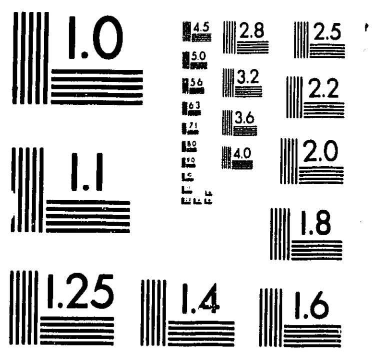
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A GLOBAL OVERVIEW OF RISK MANAGEMENT OF THE DOE COMPLEX

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ABSTRACT

No endeavor is risk-free and as we realize the inherent risks in society, our only viable solution is to manage the risk. Application of an integrated risk management program of a large technological system like the DOE complex is a difficult, task; but it is the only rational means to optimize the risk-benefit equation.

An effective risk management culture within the DOE complex will in the long run, ensure a consistent response to mitigate identified risks.

An effective risk management program provides responsible administrative planning and logical application of the best technical analyses. It requires the involvement of all personnel.

A risk management program utilizes the following broad risk management principles:

1. Integration
2. Risk/safety goal
3. Risk awareness and perception
4. Planning, communication and implementation for risk avoidance, risk mitigation and risk benefit optimization
5. Risk management tools: risk assessment and decision analysis.

Some specific elements are: hazard identification, risk assessment, risk mitigation, emergency planning, incident investigation, audits, training, procedures (operating, maintenance, testing and inspection, and change control), and continuous improvements through feedback.

Currently, risk management methods, applications, and results have not yet been demonstrated in a uniform self-consistent effort throughout the DOE complex.

The quality assurance review of so many diverse applications, methods, and differing results presents a complex risk management issue for DOE.

Our objective in this paper is to point out broad perspectives that raise concerns about future DOE risk management issues and to suggest some possible remedies.

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A GLOBAL OVERVIEW OF RISK MANAGEMENT OF THE DOE COMPLEX

1.0 INTRODUCTION

1.1 Background

The DOE complex consists of a diversity of facility types including; reactor, non-reactor, weapons, chemical process, and others. Many of these diverse facilities are physically located in a single geographical location (See Table 1). These facilities operate complex technological systems that have potential risks (like any other modern technological process) to facility personnel, the general public and the environment.

As the global political changes have affected DOE/DOD planning and policy, new priorities have emerged. The nuclear weapons dismantlement efforts have become a primary focus of safety and risk assessment. Only very recently a general awareness about these risks has developed within the DOE organization. This is a fallout of (1) the general public recognition of the risk of any complex system that was precipitated in the wake of the such events as TMI, Chernobyl, Challenger, and Bhopal, and (2) as the external threat of war has diminished, the willingness of the public to accept nuclear weapons related risks has diminished.

DOE has recognized the value of risk management as an additional dimension of its activities and performance. However, this recent recognition has not translate into a uniformly focused activity. This may be due to such various reasons as:

1. Organizational diversity and jurisdictional complexity among diverse organizations.
2. Lack of independence of regulators from the operating authority and the absence of regulatory enforcement authority at the facility.
3. Fragmentation of regulatory criteria and absence of independent regulatory process.
4. Uncoordinated regulatory practices among multiple regulatory authorities, e.g., DOE, NRC, EPA, OSHA, state and local governments.
5. Inertia of the old culture.
6. Rate of introduction of the new risk-based culture throughout the complex.
7. Lack of consistent goals, policy, criteria, and methods commensurate with facility type and functional process.
8. Lack of expertise, training, tools, data bases, and organizational structures through out the complex.
9. Recognition of the usefulness of information generated at a facility and its implication on the benefit and cost parameters.
10. Rational implementation of the policy, goal, criteria commensurate with the nature, magnitude and other important attributes of risk.

Other industries, viz., aerospace and commercial nuclear power, have been applying the methodologies of risk assessment for quite sometime and are lately applying integrated risk management techniques to make rational business decisions. In the DOE complex the recent activities devoted to risk management process seems to be very limited and preliminary results in many cases show unrealistic low magnitudes of estimated risk (See Figures 1, 2).

1.2 Objective

Our objective in this paper, is to give an overview of the status of risk management activities in the DOE complex. A comparison of the status is made with that of the commercial nuclear industry to get a perspective on the state-of-affairs in the DOE complex.

2.0 UNIQUE ACTIVITIES AT THE DOE COMPLEX

Risk Management at the DOE Complex has unique aspects that differ significantly from other industries. Some of those major aspects are: plutonium handling, tritium handling, transportation of nuclear weapons and weapons grade materials through wide regions of the country, safeguards of special nuclear materials and weapons, and interface with Department of Defense.

Modernization and consolidation of the DOE Complex in the Complex-21 Reconfiguration has been considered. It will be important to integrate these efforts with a risk assessment of the complex as a whole, so that rational decisions may be made. Risk comparisons of alternate configurations could be valuable to the decision makers.

Another area of concern is weapons grade plutonium disposition in the United States and the former Soviet Union which will be available from the dismantling of the weapons. In this area also, elements of risk management principles could provide some insights in choosing between alternatives. For example, whether "burning" of the mixed oxide fuel in a suitable reactor is more desirable compared to vitrification and disposal of plutonium in geologic repository or some other alternative.

3.0 STATUS OF RISK MANAGEMENT ACTIVITIES

Throughout the DOE complex there have been very few complete probabilistic risk assessments (PRA) performed. Only recently, Savannah River Plant submitted the Safety Analysis Report to DOE/DP that contains PRA. A few of the other facilities, such as the N-Reactor at Hanford and High Flux Test Facility (HFIR) at Oak Ridge have done PRA using similar modeling techniques that have been applied to commercial nuclear plants. A number of other facilities are also performing PRA of their facilities. The status of these studies is summarized in Table 1.

Previously master studies were performed for the DOE complex which were hazard analysis and lacked quantitative analysis. Applications are now being performed in the weapons community reporting accident events as 10^{-12} per year. Such a low value is <u>not</u> indicative of safe weapons. It <u>is</u> indicative of PRA efforts that overly limit scope (no common cause/mode analysis, no human factors analysis, and no external events analysis) and use inappropriate non-conservative simplifying assumptions (statistical independence and over-extrapolation of data).

4.0 RECOMMENDATIONS AND CONCLUSION

We would like to recommend that data on related DOE risk assessments be evaluated similarly to NRC's NUREG 1150 study.

TABLE 1: DOE FACILITIES

Location	Site	Facility	PRA Studies*	
			Completed	In Progress
Albuquerque (AL)	Allied Signal	1		
Albuquerque (AL)	EG&G Mound	8		
Albuquerque (AL)	General Electric	2		
Albuquerque (AL)	M.K. Ferguson	1		
Albuquerque (AL)	Mason & Hanger-Silas	2		
Albuquerque (AL)	Sandia (Albuquerque)	2		
Albuquerque (AL)	Sandia (Livermore)	2		
Albuquerque (AL)	University of California	9		
Albuquerque (AL)	Westinghouse Albuquerque	1		
Chicago (CH)	Brookhaven National Lab-BNL	5		
Chicago (CH)	Princeton University	1		
Chicago (CH)	Universities Research Association	1		
Chicago (CH)	University of Chicago/ANL	10		
Chicago (CH)	University of Tenn./Space Instit.	1		
Idaho (ID)	EG&G/Idaho	6		
Idaho (ID)	Mountain States Energy Inc.-MSE	1		
Idaho (ID)	West Valley Nuclear Services (Westinghouse)	1		
Idaho (ID)	Westinghouse Industries Nuclear Corp.	2		
Nevada (NV)	EG&G/Energy Measurements	1		
Nevada (NV)	REECO, EG&G, et al	1		
Nevada (NV)	Reynolds Electric Engineering Co.	1		
Oak Ridge (OR)	Bechtel Oak Ridge	2		
Oak Ridge (OR)	Boeing Petroleum Services -BPS	1		
Oak Ridge (OR)	M.K. Ferguson	1		
Oak Ridge (OR)	Martin Marietta Energy Systems	16		
Oak Ridge (OR)	Westinghouse Oak Ridge	2		
Rocky Flats (RF)	EG&G/Rocky Flats	4		
Richland (RL)	Westinghouse Hanford Co.-WHC	10		
San Francisco (SAN)	Bechtel Corp.	1		
San Francisco (SAN)	Rockwell International	1		
San Francisco (SAN)	Stanford University	1		
San Francisco (SAN)	University of California-LBL	3		
San Francisco (SAN)	University of California-LLNL	9		
Savannah River (SR)	Westinghouse Savannah River Co.-WSR	0		

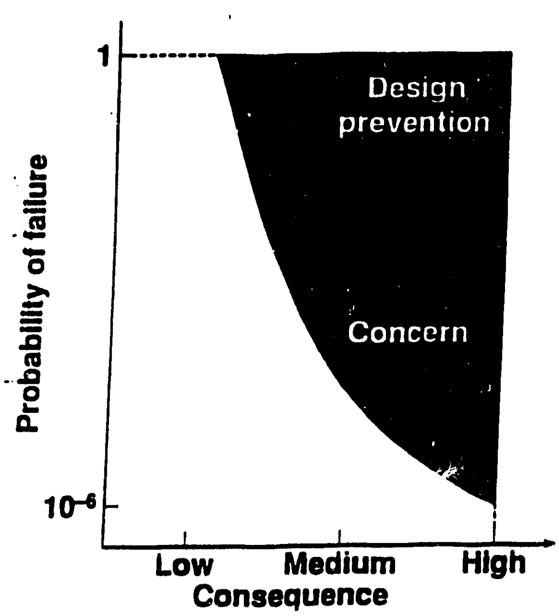
***Available upon request at the PSAM Conference.**

TABLE 2: WEAPONS RELATED PRA

Risk Assessment	Planned	*
B57 Level 1	9/93	
W79 Level 1	9/93	
W48 Level 1	2/94	
W68 Level 1	6/94	
W69 Level 1	6/94	
W70 Level 1	12/94	
B61-0,2 Level 1	12/94	
W56 Level 1	4/95	
W62 Level 1	10/95	
Pantex Onsite Tra	1/94	
Pantex Staging/sto	1/95	
Pantex Assembly	3/95	
NTS Arming & Firing	1/94	
NTS Assembly, Disassembly	3/94	
NTS Insertion, Inst	12/94	
NTS Offsite	10/94	

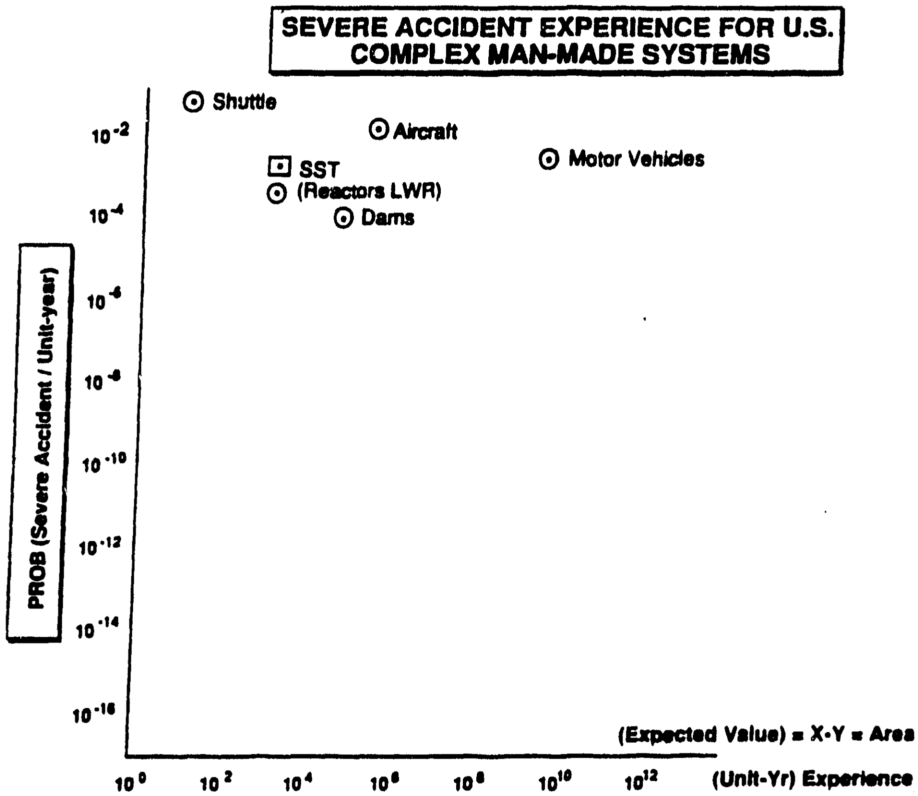
*** Available upon request at the PSAM Conference.**

Figure 1



Type of analysis	Data needed
Quality Assurance	Expert judgment
PRA	Component failure data to estimate system failure
Reliability Analysis	Need system & component failure data

Figure 2


SEVERE ACCIDENT EXPERIENCE FOR U.S. COMPLEX MAN-MADE SYSTEMS
Shuttle
Aircraft
Motor Vehicles
SST
(Reactors LWR)
Dams
PROB (Severe Accident / Unit-year)
10^-2
10^-4
10^-6
10^-8
10^-10
10^-12
10^-14
10^-16
(Expected Value) = X·Y = Area
10^0
10^2
10^4
10^6
10^8
10^10
10^12
(Unit-Yr) Experience

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