

**REVIEW OF THE U.S. DEPARTMENT OF ENERGY'S USE OF RISK
ANALYSIS IN ENVIRONMENTAL MANAGEMENT DECISION
MAKING**

BY

**THE PEER REVIEW COMMITTEE OF
THE CONSORTIUM FOR RISK EVALUATION
WITH STAKEHOLDER PARTICIPATION (CRESP),
ARTHUR C. UPTON, CHAIRMAN**

BACKGROUND

AT THE REQUEST OF THE MANAGEMENT BOARD OF THE CONSORTIUM FOR RISK EVALUATION WITH STAKEHOLDER PARTICIPATION (CRESP), THE CRESP PEER REVIEW COMMITTEE EVALUATED THE RECENT HISTORY OF THE USE OF RISK ANALYSIS BY THE U.S. DEPARTMENT OF ENERGY (DOE) IN PRIORITIZING ITS ENVIRONMENTAL MANAGEMENT ACTIVITIES.

IN AN EFFORT TO ENSURE ADEQUATE COVERAGE OF THE INFORMATION NEEDED FOR THE PURPOSE, THE COMMITTEE INTERVIEWED A NUMBER OF THE DEPARTMENT'S SENIOR ENVIRONMENTAL MANAGEMENT PERSONNEL FOR INPUT INTO ITS EVALUATION.

THE FINDINGS AND RECOMMENDATIONS RESULTING FROM THE COMMITTEE'S EVALUATION, SUMMARIZED HERE, WERE PRESENTED IN DECEMBER 1999 IN A REPORT WHICH HAS SINCE BEEN MADE AVAILABLE ON THE CRESP WEBSITE: ([HTTP//WWW.CRESP.ORG](http://www.cresp.org)).

DOE'S ENVIRONMENTAL MANAGEMENT **DECISION PROBLEM**

ALTHOUGH THE CONTROL OF RISKS TO HUMAN HEALTH AND THE ENVIRONMENT IS THE PRINCIPAL GOAL OF DOE'S ENVIRONMENTAL MANAGEMENT PROGRAM, THE PROGRAM MUST ALSO ADDRESS SEVERAL OTHER IMPORTANT OBJECTIVES, INCLUDING:

- **COMPLIANCE WITH PERTINENT LEGAL AND REGULATORY REQUIREMENTS,**
- **ACHIEVEMENT OF MORTGAGE REDUCTION,**
- **MINIMIZATION OF SOCIOECONOMIC, CULTURAL, AND LAND-USE IMPACTS,**
AND
- **MINIMIZATION OF MISSION IMPACT**

IN ORDER TO COPE WITH THE MULTIPLICITY OF ITS OBJECTIVES, THE PROGRAM MUST USE AN APPROPRIATE METHOD FOR PRIORITIZING AND SEQUENCING ITS ENVIRONMENTAL MANAGEMENT ACTIVITIES.

DOE'S EVOLVING EFFORTS TO DEVELOP AN APPROPRIATE PRIORITIZATION METHOD

IN RECENT YEARS, DOE HAS EXPLORED VARIOUS APPROACHES IN EFFORTS TO DEVELOP AN APPROPRIATE RISK-BASED PRIORITIZATION METHOD FOR USE IN ENVIRONMENTAL MANAGEMENT DECISION MAKING. THE SUCCESSIVE APPROACHES IT HAS EXPLORED INCLUDE THE FOLLOWING:

- **THE PROGRAM OPTIMIZATION SYSTEM, 1988-1990**
- **THE ENVIRONMENTAL RESTORATION PRIORITY SYSTEM, 1990-1993**
- **THE RISK DATA SHEET SCORING SYSTEM, 1995-1996**
- **PROJECT BASELINE SUMMARIES, 1997-**
- **ACCELERATED CLEANUP: PATHS TO CLOSURE, 1998**
- **SITE RISK PROFILES, 1999**
- **INTEGRATOR OPERABLE UNIT AND COMPOSITE ANALYSES, 1999-2000**

THE ABOVE APPROACHES DIFFER APPRECIABLY IN STRENGTHS AND WEAKNESSES, SOME BEING JUDGED HIGHLY PROMISING BY OUTSIDE REVIEWERS. THUS FAR, HOWEVER, NO APPROACH HAS BEEN PURSUED VIGOROUSLY ENOUGH OR LONG ENOUGH BY DOE TO DEVELOP ADEQUATELY, OWING TO LACK OF CONFIDENCE IN THE APPROACH OR TO LACK OF SUPPORT FOR IT BY STAKEHOLDERS.

WEAKNESSES IN THE APPROACHES DOE HAS USED THUS FAR

ALTHOUGH THE SUCCESSIVE PRIORITY-SETTING APPROACHES EXPLORED BY DOE HAVE VARIED APPRECIABLY IN STRENGTHS AND WEAKNESSES, ALL OF THEM HAVE SHARED TO VARYING DEGREES THE FOLLOWING MAJOR SHORTCOMINGS:

- **INADEQUACIES IN THE INPUT DATA USED FOR RANKING A GIVEN ENVIRONMENTAL MANAGEMENT ACTIVITY**
- **INADEQUATE DOCUMENTATION OF THE BASIS FOR THE RANK ASSIGNED TO A GIVEN ACTIVITY**
- **INCONSISTENCIES IN SCORING PRACTICES AMONG SITES**
- **FAILURE TO RELATE A GIVEN ACTIVITY TO THE SPECIFIC ENVIRONMENTAL OBJECTIVE IT WAS INTENDED TO ADDRESS**
- **INADEQUACIES IN THE ASSESSMENT OF RISKS TO HEALTH AND THE ENVIRONMENT**
- **INSUFFICIENT CLARITY AND TRANSPARENCY IN THE RANKING PROCESS**
- **LACK OF ADEQUATE CREDIBILITY AND ACCEPTABILITY OF THE PROCESS TO IN-HOUSE PERSONNEL, CONTRACTORS, AND/OR OTHER STAKEHOLDERS**

CONCLUSIONS

TO ADDRESS THE PRINCIPAL GOAL OF ITS ENVIRONMENTAL MANAGEMENT PROGRAM, WHICH IS THE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT, IT IS ESSENTIAL THAT DOE USE A RISK-BASED APPROACH FOR PRIORITIZING AND SEQUENCING ITS ENVIRONMENTAL MANAGEMENT ACTIVITIES.

AT THE SAME TIME, ANY APPROACH THAT DOE USES FOR THE PURPOSE MUST ALSO ADDRESS THE PROGRAM'S OTHER IMPORTANT OBJECTIVES, WHICH INCLUDE COMPLIANCE WITH PERTINENT LAWS AND REGULATIONS, MINIMIZATION OF SOCIOECONOMIC, CULTURAL, AND LAND USE IMPACTS, AND SELECTION OF RISK MANAGEMENT OPTIONS THAT ARE APPROPRIATELY COST-EFFECTIVE.

ALTHOUGH NONE OF THE VARIOUS PRIORITY-SETTING APPROACHES DOE HAS EXPLORED FOR THE PURPOSE IN RECENT YEARS HAS BEEN ENTIRELY SATISFACTORY, NONE HAS BEEN PURSUED VIGOROUSLY OR LONG ENOUGH BY DOE TO DEVELOP ADEQUATELY, OWING MAINLY TO LACK OF CONFIDENCE IN THE APPROACH OR LACK OF SUPPORT FOR IT BY STAKEHOLDERS.

CONCLUSIONS (CONT'D.)

THE SUCCESSIVE PRIORITY-SETTING APPROACHES EXPLORED THUS FAR BY DOE HAVE VARIED WIDELY IN THEIR SPECIFIC STRENGTHS AND WEAKNESSES, BUT ALL OF THEM HAVE SUFFERED TO VARYING DEGREES FROM: INADEQUACIES IN THE INPUT DATA THAT HAVE BEEN USED TO RANK A GIVEN ENVIRONMENTAL MANAGEMENT ACTIVITY; DEFICIENCIES IN THE METHODOLOGY USED FOR ASSESSING RISKS TO HUMAN HEALTH AND THE ENVIRONMENT; INCONSISTENCIES IN SCORING PRACTICES WITHIN AND ACROSS SITES; INADEQUATE DOCUMENTATION, CLARITY, AND TRANSPARENCY OF THE SCORING PROCESS; AND LACK OF CREDIBILITY AND ACCEPTABILITY OF THE PROCESS TO STAKEHOLDERS.

TO REMEDY THESE AND OTHER DEFICIENCIES, A NUMBER OF SUBSTANTIAL CHANGES ARE CALLED FOR.

RECOMMENDATIONS

TO IMPROVE THE PROCESS THAT DOE USES FOR PRIORITIZING ITS ENVIRONMENTAL MANAGEMENT ACTIVITIES, THE FOLLOWING STEPS ARE RECOMMENDED:

- 1. DOE SHOULD DEVELOP AND IMPLEMENT APPROPRIATE STRATEGIES FOR RESPONSIBLE INTERIM AND LONG-TERM ENVIRONMENTAL STEWARDSHIP, BASED ON SOUND PRINCIPLES OF RISK ASSESSMENT AND RISK MANAGEMENT**
- 2. TO THIS END, DOE SHOULD ESTABLISH A PROCESS, EITHER INSIDE OR OUTSIDE THE DEPARTMENT, FOR DEVELOPING THE NEEDED METHODOLOGY AND FOR ALLOWING THE METHODOLOGY TO BE ADEQUATELY PILOT-TESTED BEFORE IT IS APPLIED ACROSS THE COMPLEX**
- 3. DOE SHOULD TAKE STEPS TO ENSURE THAT:**
 - THE METHODOLOGY IS CONSISTENT ACROSS THE SITES**
 - THE PROCESS IS COMMUNITY-BASED, ACCOMPLISHED LOCALLY, AND INVOLVES THE RELEVANT PERSONNEL AND STAKEHOLDERS AT ALL STAGES**
 - APPROPRIATE PROVISIONS ARE MADE FOR VARIATIONS IN RISK PARAMETERS THAT MAY BE NECESSITATED BY DIFFERENCES AMONG COMMUNITIES IN VALUES AND NEEDS**

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RECOMMENDATIONS (CONT'D.)

4. INCREASED ATTENTION SHOULD BE DEVOTED TO THE FOLLOWING SPECIFIC RISK-RELATED ISSUES:

- **THE NEED FOR A MORE INTEGRATED APPROACH TO RISK ASSESSMENT AT SITES CONTAINING MULTIPLE SOURCES OF CONTAMINATION THAN WOULD SUFFICE FOR COMPLIANCE PURPOSES ALONE**
- **THE NEED TO INCLUDE EXPOSURE ASSESSMENT AS A KEY STEP IN ANY RISK ASSESSMENT**
- **THE NEED TO ASSESS THE POTENTIAL IMPACTS OF REMEDIATING ACTIVITIES ON THE HEALTH OF THE WORKERS WHO ARE INVOLVED**
- **THE NEED TO CONSIDER CHEMICAL HAZARDS AS WELL AS RADIATION HAZARDS**
- **THE NEED TO ADDRESS ECOLOGICAL RISKS**
- **THE NEED TO EVALUATE POTENTIAL SOCIOECONOMIC, CULTURAL, AND LAND-USE IMPACTS**
- **THE NEED FOR EACH RISK ASSESSMENT TO BE TRANSPARENT AND DOCUMENTED APPROPRIATELY**
- **THE NEED FOR THE HAZARDOUS AGENTS AND POTENTIAL EXPOSURE PATHWAYS IN ANY RISK ASSESSMENT TO BE SUMMARIZED CLEARLY ENOUGH SO THAT THE ASSESSMENT CAN BE CREDIBLE AND USEFUL**

RECOMMENDATIONS (CONT'D.)

5. THE DEVELOPMENT OF THE NEEDED APPROACH OUGHT TO:

- BE CARRIED OUT AT THE ENVIRONMENTAL PROJECT LEVEL, WITH SITE GEOGRAPHY AND STAKEHOLDER CULTURES TAKEN INTO ACCOUNT;**
- BUILD ON THE POSITIVE ASPECTS AND LIMITATIONS OF EARLIER EFFORTS; AND**
- BE GIVEN ENOUGH TIME AND RESOURCES TO ENABLE THE APPROACH TO BE EVALUATED CAREFULLY BEFORE IT IS IMPLEMENTED BROADLY**

RECOMMENDATIONS (CONT'D.)

6. INCREASED ATTENTION SHOULD BE DEVOTED TO THE FOLLOWING SPECIFIC RISK-RELATED ISSUES:

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RECOMMENDATIONS (CONT'D.)

- 7. THE DEVELOPMENT OF THE NEEDED APPROACH OUGHT TO:**
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 - **BUILD ON THE POSITIVE ASPECTS AND LIMITATIONS OF EARLIER EFFORTS; AND**
 - **BE GIVEN ENOUGH TIME AND RESOURCES TO ENABLE THE APPROACH TO BE EVALUATED CAREFULLY BEFORE IT IS IMPLEMENTED BROADLY**

THE CRESP PEER REVIEW COMMITTEE

THE MEMBERS OF THE CRESP PEER REVIEW COMMITTEE INVOLVED IN THE CONDUCT OF THIS EVALUATION INCLUDED THE FOLLOWING:

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

Costner, Brian, Seattle, Washington*

Erikson, Kai, Ph.D., Professor of Sociology, Yale University

Fairhurst, Charles, Ph.D., Professor of Civil & Mineral Engineering, University of Minnesota

Jasanoff, Sheila, Ph.D., Professor of Science & Public Policy, Harvard University

Parker, Frank, Professor of Engineering, Vanderbilt University*

Jim, Russell, Yakima Indian Nation

Kimbrough, Renate D., M.D., Institute for Evaluating Health Risks

Lippmann, Morton, Ph.D., Professor of Environmental Medicine, New York University Medical Center

Russell, Milton, Ph.D., Emeritus Professor of Economics, University of Tennessee

Tano, Mervyn, General Counsel, International Institute for Indigenous Resource Management

Tschinkel, Victoria, Consultant, Landers & Parsons, Tallahassee, Florida*

Upton, Arthur C., M.D., Professor of Environmental & Community Medicine, UMDNJ-Robert Wood Johnson Medical School**

Walker, Bailus Jr., Ph.D., M.P.H., Professor of Environmental & Occupational Medicine, Howard University

Whipple, Chris, Ph.D., ICF Kaiser, Oakland, CA*

Zeise, Lauren, Ph.D., California Environmental Protection Agency

***Ad Hoc Member of Committee**

****Chairman of Committee**

PERSPECTIVES ON SPECIFIC APPROACHES

PROGRAM OPTIMIZATION SYSTEM (POS)

**DEVELOPED IN 1988 BY THE DEFENSE PROGRAMS UNIT, IN RESPONSE TO A CONGRESSIONAL
DIRECTIVE FOR ESTABLISHMENT OF A PRIORITIZATION SYSTEM FOR FUNDING
ENVIRONMENTAL RESTORATION**

ELICITED RESISTANCE BY RECOMMENDING MAJOR REALLOCATIONS OF RESOURCES ACROSS SITES

ENVIRONMENTAL RESTORATION PRIORITY SYSTEM

EVOLVED FROM THE POS IN 1988-1990, WITH AIM TO:

- 1) INCLUDE GREATER BREADTH OF SCORING CRITERIA,**
- 2) NOT BE LIMITED TO DOE DEFENSE PROGRAMS FACILITIES,**
- 3) SERVE AS AN EXTERNAL TOOL, WITH OUTSIDE INVOLVEMENT**

ELICITED RESISTANCE BY ITS LACK OF TRANSPARENCY AND REQUIREMENT FOR A TRADE-OFF

ANALYSIS IN WHICH ALL EFFECTS WERE TO BE COVERED INTO COSTS

NOT IMPLEMENTED BECAUSE OF STAKEHOLDER RESISTANCE

RISK DATA SHEET SCORING SYSTEM

INTRODUCED IN 1995 BY EM FOR BUDGET FORMULATION

**ENVIRONMENTAL MANAGEMENT ACTIVITIES RATED ON A STANDARDIZED FORM FOR EACH OF
FOLLOWING OBJECTIVES:**

- 1) PUBLIC HEALTH AND SAFETY**
- 2) SITE PERSONNEL HEALTH AND SAFETY**
- 3) ENVIRONMENTAL PROTECTION**
- 4) COMPLIANCE WITH PERTINENT LAWS AND REGULATIONS**
- 5) MORTGAGE REDUCTION**
- 6) AVOIDANCE OF SOCIAL, CULTURAL, ECONOMIC IMPACTS**
- 7) AVOIDANCE OF MISSION IMPACT**

WEAKNESSES:

EACH ACTIVITY RATED ONLY ON A ONE-YEAR TIME HORIZON

ACTIVITY NOT CLEARLY RELATED TO ITS INTENDED OBJECTIVE

SCORING PRACTICES WERE NOT CONSISTENT ACROSS SITES

INADEQUACIES AND INADEQUATE DOCUMENTATION OF INPUT DATA

LACK OF TRANSPARENCY AND STAKEHOLDER INVOLVEMENT

REPLACED, IN 1997, WITH THE INTRODUCTION OF THE NATIONAL 2006 PLAN

PROJECT BASELINE SUMMARIES

**FROM FALL OF 1997, EACH FIELD OFFICE REQUIRED BY NATIONAL 2006 PLAN TO SUBMIT A PROJECT
BASELINE SUMMARY (PBS) FOR EACH APPROVED PROJECT**

**EACH PBS TO SERVE AS THE PROJECT'S MAJOR MANAGEMENT TOOL AND TO INCLUDE DETAILED
SUMMARY OF PROJECT'S SCOPE, SCHEDULE, COST BASELINE, LIFE-CYCLE METRICS, ANNUAL
PERFORMANCE TARGETS, AND OTHER INFORMATION, INCLUDING RELEVANT DATA ON RISK,
HEALTH, AND SAFETY**

MAJOR WEAKNESSES:

**RISK ASSESSMENTS INADEQUATE AND INADEQUATELY DOCUMENTED
LACK OF TRANSPARENCY AND CREDIBILITY TO STAKEHOLDERS**