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SUBJECT: ASQC Fifth International Environmental and Waste Management Conference
AD 20-5702-331-408

DATE/PLACE: Las Vegas, NV
April 17-20, 1994

AUTHOR: Bruce Mabrito

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April 17-20, 1994

AUTHOR: Bruce Mabrito

PERSONS PRESENT:

CNWRA	NRC-DWM
B. Mabrito	None

Over 240 individuals attended the Conference and a list of the attendees is presented in Attachment A.

BACKGROUND AND PURPOSE OF TRIP:

The American Society for Quality Control (ASQC) Energy and Environmental Quality Division annually holds an Environmental and Waste Management Conference in Las Vegas. The underlying theme in this year's Conference was "Revitalizing Environmental Relationships." CNWRA QA staff have attended this Conference in previous years and have found it to be one of the regular conferences with its subject directly pertaining to high-level waste (HLW) repository activities, which also has the added benefit of being heavily attended by U.S. Environmental Protection Agency (EPA) staff and contractors of the EPA. No one from the U.S. Nuclear Regulatory Commission (NRC) was planning to attend this Conference, so it was determined by the NRC External QA Program Element Manager that attendance by a CNWRA QA staff member was appropriate. Many individuals currently participating in the Department of Energy (DOE) HLW program, or contracted to the DOE HLW program, also attended this Conference. The purpose of the trip was to bring back information on the presentations, meet informally with DOE HLW participant counterparts, and, to the extent possible, be a representative for the NRC. The additional benefit of this Conference is that the staff and/or contractors for the three U.S. Government Agencies involved in the HLW repository specific regulations (DOE, EPA, and NRC) have in the past met at this conference and exchanged information and ideas.

SUMMARY OF PERTINENT POINTS:

The Conference Abstracts booklet briefly mentioned that the "Misunderstandings and turf battles between the 'regulators and the regulated' have only produced schedule delays, increased costs and ruined careers." The Abstracts booklet additionally stated that "One of our speakers was the primary author of NUREG-1055, a study commissioned by Congress over ten years ago which produced lessons learned from the commercial nuclear construction program. There are many parallels between the mission of environmental restoration and the mission of the commercial nuclear industry 15 years ago. One very important lesson from the NUREG is the importance of a good working relationship between the owner and the regulator; it will impact the success of any regulated program."

W.D. Altman, Ph.D., author of "Improving Quality and the Assurance of Quality in the Design and Construction of Nuclear Power Plants," NUREG-1055, May 1984, presented his view of "NUREG-1055, Lessons Learned: 10 Years Later." His presentation was one of over 55 presentations made during the three-day conference. Although there are factors which clearly differentiate the characterization of a potential high-level waste repository site from the construction of a nuclear power plant, W. Altman did emphasize numerous points which have a definite bearing on the NRC/DOE site characterization activities and interfaces, some of which are included below.

- The study identified that in most cases, the quality problems that the regulators (NRC) found were manifestations of other, deeper problems that pervaded the very fabric of the project, such as: inadequate records systems; incorrect sequencing of work activities; unavailability of certain tools or materials when needed; inadequate understanding of work scope at outset; contracting practices inappropriate for level of understanding of work scope; insufficiently qualified or experienced project staff; and insufficient understanding of regulatory requirements.

- Successful projects had effective project management arrangements characterized by: strong project managers; clearly defined project roles and responsibility; delegated authority sufficient to meet responsibilities; effective management up and down; and effective cost management, planning, and scheduling.

- The quality problems of several projects were due in part to the lack of a team approach within the immediate and extended project team family.

- Examples of conflicts, attitudes, or project arrangements not conducive to a team approach included: QC versus crafts; QA versus QC; QA/QC versus construction; should construction QC report to the construction manager; engineering arrogance, QA/QC does not apply to us; construction versus operations, facilitating system turnover; construction versus engineering, turf battle; project manager without sufficient resources begging entrenched turf (e.g., construction, engineering) for help.

- The successful projects solved these problems through: strong project management; clearly defined roles and responsibilities; visible, relevant senior management involvement and leadership; communication; restructuring their way of doing business to ensure project success; and establishing dedicated project teams with the authority to obtain the resources and priorities needed. There was a strong correlation between a project's ability to adjust to and manage change and project success.

W. Altman reviewed the NUREG-1055 lessons learned and compared them to the Department of Energy Environmental Management Project Performance Study accomplished in 1993. Viewgraphs of this presentation are provided as Attachment B to this Trip Report because of the importance of this subject and the possible transference of conclusions to our NRC/DOE HLW work.

Although the Administrator of the EPA and the Secretary of the DOE had been invited to address the conference, substitute representatives from each organization were instead sent. Nancy Wentworth, who currently serves as the Director of the Quality Assurance Management Staff (QAMS) at the EPA, was a co-keynote speaker along with Pat Whitfield, Deputy Assistant Secretary for Environmental Restoration for the DOE's Office of Environmental Restoration and Waste Management. They both emphasized the overriding need for team building, consistency in operations, and full communications in all areas of work.

Llewellyn R. Williams, Senior Science Advisor for the EPA Environmental Monitoring Systems Laboratory, described his efforts to develop an interagency committee on QA for Environmental Measurement, to streamline QA documentation, and to integrate the "philosophy of quality" into all day-to-day operations at the Las Vegas EPA laboratory. His talk was entitled "Building Consistency in Waste Management and Remediation Activities: What do the Regulators Need?" Williams' presentation emphasized these additional points: the system must be changed to become and be more efficient; work procedures should definitely be "outcome oriented;" strong partnerships should be forged to achieve the stated goals; a safe and productive workplace should be provided personnel working on environmental monitoring projects; and efforts should be directed to manage and ultimately eliminating "urgent threats" to the project goals.

Joan Fisk, of Los Alamos National Laboratory and the moderator for the Analytical Requirements for Waste Management Activities panel discussion, gave her views in light of the Super Fund site work. She stated that consistency is needed from the regulators, a process and a "standard way of thinking about things" is what is required, and "the EPA is responsible to make that happen." Richard Bauer, a QAMS representative in EPA Region 9, drew the analogy that they are trying to be "missionaries" in selling QA, not trying to be QA policemen in the field. He stated that the EPA recognizes the inconsistency of data requirements among the EPA regions, and they are concentrating on "what the EPA end product should look like."

Looking to the future, Gary L. Johnson of the QAMS Research Triangle Park EPA operation, spoke on applying the International Organization for Standardization (ISO) 9000 series to Waste Management activities. Published initially in 1987, ISO 9000 has gained a considerable following in the U.S. and Europe as the basis of various quality systems. Johnson admitted that for the environmental QA professional, the utility of ISO 9000 has been questionable in the past. G. Johnson then discussed the final draft of the ANSI/ASQC E4 document, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," and provided copies by mail to individuals who requested them. ANSI/ASQC E4, like ISO 9000 (or ANSI/ASQC Q90-1987, as it is known in the U.S.), is a voluntary standard and becomes mandatory only when invoked by a user organization. The ANSI/ASQC E4 standard incorporates relevant elements from existing standards and guidelines, including NQA-1 (1989) and the ANSI/ASQC Q90, and presents them from an environmental perspective.

Dale A. Bewley, Martin Marietta Energy Systems at Oak Ridge National Laboratory, was the moderator for a plenary session entitled, "Industry Perspectives on Revitalizing Environmental Relationships." During the session he presented his "Five Rules for Dealing with Regulators," which were: (i) view the regulator as your customer; (ii) don't take "shaky issues" to the regulator; (iii) use the regulator's models rather than your own; (iv) have a strong peer review by the regulator's suggested peer review groups; and (v) remember that the regulator also has customers. Bewley stated that his organization likes to present a complete final product package to their regulator which includes rationales, a full history package of what was done, why it was done, and the results. Such comprehensive packages are useable by most organizations far into the future.

Steven R. Dana, Science Applications International Corporation (SAIC) at Las Vegas, NV, presented "The History of the Civilian Radioactive Waste Management Quality Assurance Requirements," in which he correctly made the following assessment: "Having so many documents concerning QA led to confusion, inconsistencies and misinterpretations of requirements. The Office of Civilian Radiation Waste Management QA Requirements and Description document (QARD, DOE/RW-0333P, dated December 1992) is now the single definitive source for the Civilian Radioactive Waste Management System QA Program requirements." He expressed the view that it is sufficiently flexible to allow affected organizations to develop and implement process methods tailored to fit their specific activities and still meet regulatory requirements. S. Dana has been regularly involved in the QA auditing of DOE HLW participants through his position at SAIC Technical and Management Support Services.

IMPRESSIONS AND CONCLUSIONS:

Although this conference over the years has become more oriented toward environmental and EPA issues, it still covers sufficient HLW matters to be of value to CNWRA QA staff members. It is beneficial to CNWRA staff to gain insight into other federal agency QA standards and requirements for waste facilities. Not surprisingly, among the EPA contractor staff that was present, it was clear from what was stated both on and off the record, most of them believe that applying "nuclear standards" to non-nuclear waste storage sites is clearly excessive and would work to remove such a standard if it was imposed.

Following the conference, I received a number of documents from the participants, including that latest draft revision (January 1994) of the "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs, ANSI/ASQC E4-19xx." Bob Brient of the CNWRA QA staff had been an unofficial reviewer of this document in its formative stages. The ANSI/ASQC E4 document describes the minimum set of quality management specifications required to conduct programs involving environmental data collection and evaluation, and "environmental technology design, construction, and operation."

All documents obtained from the conference will be circulated to CNWRA management staff and will be retained in my office if needed for reference at a future date.

PENDING ACTIONS:

None.

RECOMMENDATIONS:

CNWRA time and resources permitting in future fiscal years, this ASQC conference should be considered as one to attend in which the individual requirements and goals of the DOE, EPA and NRC are discussed.

PROBLEMS:

None.

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ATTACHMENT A

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ATTACHMENT B

NUREG-1055

Lessons Learned:

10 Years Later

Presented to:

The Fifth International Environmental and
Waste Management Conference
American Society for Quality Control

April 20, 1994

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Agenda

- NUREG-1055 Background
  - Footnote
- NUREG-1055 Approach
- NUREG-1055 Acceptance
- NUREG-1055 Lessons
  - Project Management
  - Qualifications & Experience
  - Project Team
  - Contracting Practices
  - Senior Management Commitment
  - Understanding the Regulators
  - Managing Change
  - Project Definition
- DOE/EM Project Performance Study
- EM Study Results
- EM Study Conclusions vs NUREG-1055 Lessons
- ERWM Initiatives

NUREG-1055 Background

- In the late 1970s and early 1980s, the commercial nuclear industry experienced quality problems in the design and/or construction of several nuclear power plants
  - — Marble Hill
  - — Midland
  - — South Texas
  - — Diablo Canyon
  - — Zimmer

- As a result of these problems, Congress (P.L. 97-415) required the Nuclear Regulatory Commission to perform a comprehensive study of nuclear power design and construction practices to
  - — determine underlying causes of the problems
  - — determine why some projects were more successful than others
  - — evaluate various alternative oversight arrangements
  - — make recommendations for regulatory and legislative changes

NUREG-1055 Background Footnote

- For the most part, problems with the nuclear power plant construction projects became evident to the NRC and Congress as a result of quality deficiencies
  - — voids in safety grade concrete
  - — improperly compacted soil
  - — tension between crafts and quality personnel
  - — design control
  - — insufficiently pedigreed welding

- As a result, the Congressional guidance in PL 97-415 focused on improvements to quality assurance programs

- The study found that the underlying causes of the problems that became evident to the regulators to go much deeper than the quality program. The underlying problems were essentially project management problems.

NUREG-1055 Approach

- The NUREG-1055 study approach incorporated the following elements:
  - case studies of nuclear power plant design/construction projects
  - case studies of non-NRC approaches to quality; e.g., NASA, DOE
  - case studies of foreign approaches to regulation of nuclear power; e.g., France, Japan
  - reviews of public utility commission (PUC) approaches to nuclear power
  - pilot programs

- The NUREG-1055 project team used the following resources
  - core team with expertise in design, construction, project management, quality, systems analysis
  - blue ribbon advisory panel with relevant nuclear and non-nuclear project and quality experience
  - resident inspectors, regional office and HQ staff and management
  - industry representatives at all levels

- Public briefings on approach and progress for
  - Advisory Committee on Reactor Safeguards
  - Nuclear Regulatory Commission

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NUREG-1055 Acceptance

- The report was sent by the Commission to Congress on schedule. Characterized as:
  - "Pioneering" by one NRC Commissioner
  - "Landmark" by one ACRS member

- The report was covered in the national media
  - McNeil Lehrer Report
  - CBS News
  - trade publications

- The ASCQ held a special topical conference on NUREG-1055
  - keynoted by Dixy Lee Ray

- DOE hosted a number of lessons learned presentations to DOE staff and contractors
  - Augusta, GA
  - Hanford, WA
  - Las Vegas, NV
  - Columbus, OH

- NUREG-1055 significantly influenced DOE's new quality requirement 5700.6C

NUREG-1055 Lessons - Project Management

- The key underlying cause of the quality problems in nuclear design and construction was poor project management

- The study found that in most cases, the quality problems that the regulators (NRC) found were manifestations of other, deeper problems that pervaded the very fabric of the project. For example,
  - inadequate records systems
  - incorrect sequencing of work activities
  - unavailability of certain tools or materials when needed
  - inadequate understanding of work scope at outset
  - contracting practices inappropriate for level of understanding of work scope
  - insufficiently qualified or experienced project staff
  - insufficient understanding of regulatory requirements

- Successful projects had effective project management arrangements characterized by:
  - strong project managers
  - clearly defined project roles & responsibility
  - delegated authority sufficient to meet responsibilities
  - effective management up and down
  - effective cost management, planning, and scheduling

NUREG-1055 Lessons - Qualifications and Experience

- The key finding was the importance of prior relevant nuclear experience. Prior experience was important for all members of the project team
  - owner
  - architect/engineer (A/E)
  - construction manager (C/M)
  - constructor (C)

- Some utilities without prior nuclear experience tended to underestimate the
  - complexity of project
  - stringency of nuclear standards
  - importance of regulators (NRC, PUC)
  - need to have senior/middle/junior level utility staff with prior nuclear experience in key project positions
  - number and qualifications of utility staff required to effectively oversee project
  - need for A/E, C/M, constructor, major contractors to have prior nuclear experience

- Because of insufficient prior experience at several project team levels, one case was characterized at one point as
  —the blind leading the blind

NUREG-1055 Lessons - Project Team

External Team

- All nuclear power plant projects have certain constituencies to satisfy:

Stakeholder		Objectives
NRC	—	ensure the plant is safe and can be demonstrated safe
PUC	—	bring plant into rate base at least cost to rate payers
Public	—	ensure the plant is needed, is safe, and will not cause rate shock

- Intertwined with these objectives, the owner/utility and contractors have their own objectives

Owner/Utility	—	bring plant on line at minimum cost to stockholder
A/E, C/M, Contractor	—	ensure jobs for people and profits for company

NUREG-1055 Lessons - Project Team (Cont'd)

External Team (Cont'd)

- The regulators and public will always have their objectives
- The more successful utilities were able to
  - understand and factor into their plans/approach the objectives of regulators and public
  - arrange their relationships with their contractors to make their objective the common objective (e.g., incentives, win/win)

The Seven Sides to the Nuclear Debate

Public Utility Commisions

- Stable construction costs
- Minimal operating risks
- Adequate financing
- Public support

Investors

- Healthy utility
- Stable construction costs
- Minimal operating risks
- Minimal political risk

Nuclear Regulatory Commission

- Confidence in technology
- Confidence in utilities
- Public support

Utilities

- Adequate return on investment
- Adequate financing
- Minimal opposition
- Predictable construction costs
- Public and political acceptance
- Predictable regulation

Noncontroversial, necessary conditions

- No major accidents
- Reactors prove reasonably reliable
- Additional generating units needed
- Cost advantage for nuclear power
- Convincing waste disposal program

Nuclear Critics

- Confidence in the technology
- Confidence in regulators and utilities
- Economic advantage
- Liabilities of other fuels proved

Nuclear Industry

- Stable licensing
- National policy
- Public acceptance
- Favorable risk/reward

Public

- Confidence in technology
- Confidence in regulators and utilities
- Less controversy
- Economic advantage
- National policy

SOURCE: Office of Technology Assessment, *Nuclear Power in an Age of Uncertainty, 1984*

NUREG-1055 Lessons - Project Team (Cont'd)

Internal Team

- The quality problems of several projects were due in part to the lack of a team approach within the utility's immediate and extended project team family - the utility/owner, A/E, C/M, C

- Examples of conflicts, attitudes, or project arrangements not conducive to a team approach included:
  - QC vs crafts
  - QA vs QC
  - QA/QC vs construction
  - should construction QC report to the construction manager?
  - engineering arrogance: QA/QC does not apply to us
  - construction vs operations: facilitating system turnover
  - construction vs engineering: turf
  - project manager without sufficient resources begging entrenched turf (e.g., construction, engineering) for help

NUREG-1055 Lessons - Project Team (Cont'd)

Internal Team (Cont'd)

- The successful projects solved these problems through
  - strong project management
  - clearly defined roles and responsibilities
  - visible, relevant senior management involvement and leadership
  - communication
  - restructuring their way of doing business to ensure project success
  - establishing dedicated project teams with the authority to obtain the resources and priorities needed

NUREG-1055 Lessons - Contracting Practices

- In some projects inappropriate contracting practices were a direct contributor to substandard quality. For example:
  - fixed-price contract
  - poorly understood scope
  - inexperienced (in nuclear) civil contractor
  - insufficient oversight by utility
  - concrete quality problems
  - contract provided no incentive for contractor to fix problems
  - problem covered up
  - NRC investigation and shutdown

- In other projects, well thought out contracting practices were contributors to project success
  - fixed-price packages only when scope is well understood
  - incentive clauses that reward the contractor for cost savings, schedule and quality success, and penalize the contractor for cost overruns, schedule slips and unacceptable quality
  - experienced, knowledgeable utility oversight
  - continuing senior management involvement by utility and A/E, C/M, C

NUREG-1055 Lessons - Senior Management Commitment

- The degree of top management involvement in, and commitment to a project strongly correlated to the degree of project success

- Characteristics of successful senior management commitment include:
  - visible, proactive commitment to the project by top management
  - frequent, on-site presence at the project site by top management
  - direct unfiltered communication between top management and all levels of project staff
  - listening to project staff and timely resolution of bubble up issues
  - restructuring corporate turf as necessary to support the project
  - assignment of staff with relevant prior experience to project team - obtaining them from outside if necessary
  - assignment of star performers to key roles on project staff, including support functions - ES&H, quality
  - assignment of sufficient resources to project, including staff, budgets, facilities and materials
  - frequent interaction on the project between senior management and project team members (utility/owner, A/E, C/M, C, regulators)

NUREG-1055 Lessons - Understanding the Regulators

- There was a strong correlation between understanding and accommodating the regulators and project success

- Examples of insufficient understanding, appreciation, and accommodation of regulators included:
  - not understanding the significant differences in codes and standards for nuclear work
  - not recognizing the power of the NRC to stop work and the significant impact of work stoppage on corporate financial health
  - viewing NRC quality requirements as unnecessary and doing the absolute minimum to meet them
  - plagiarizing another utility's PSAR submittal
  - not paying serious attention to and correcting deficiencies identified in NRC inspections
  - in some cases, developing an antagonistic relationship with the NRC

- Successful utilities tended to view NRC requirements as minimum thresholds and set their own performance standards higher

NUREG-1055 Lessons - Understanding the Regulators (Cont'd)

- Successful utilities actively worked at establishing and maintaining good relationships with NRC at all levels:
  - licensing project manager
  - licensing technical staff
  - regional inspectors
  - resident inspector
  - regional administrator
  - commissioners
  - ACRS

NUREG-1055 Lessons - Managing Change

- There was a strong correlation between a project's ability to adjust to and manage change and project success
- One of the most difficult challenges to a project manager is to successfully manage change
- For the nuclear power plant construction projects, change arose from or was affected by several sources
  - normal project change
  - changing codes and standards
  - A/E inexperience in nuclear work
  - C/M inexperience in nuclear work: bulldozer mentality
  - long period of time from project inception to completion
  - events: Browns Ferry fire, Three Mile Island accident

NUREG-1055 Lessons - Managing Change (Cont'd)

- Projects enhance their chances of managing change successfully if they have
  - experienced, qualified project team
  - well defined, well understood work scope up front
  - well defined, documented process for scope change agreed to up front
  - configuration control system rigorously adhered to at all levels of project
  - completion of the project without significant delays

NUREG-1055 Lessons - Project Definition

- There was a strong correlation between the quality of a project's up front planning and project definition and project success

- Projects without sufficient up front planning and scope definition tended to run into problems with
  - correctly sequencing work
  - defining complete work packages
  - having the correct tools and materials available when needed
  - keeping crafts busy
  - excessive rework
  - morale problems/conflicts among crafts, supervision and quality
  - schedule slips
  - cost overruns

- Projects with effective up front planning and scope definition tended to
  - pay a lot of attention to up front planning
  - have prior relevant nuclear experience or hire it for key project roles
  - consciously work at and achieve effective relationships with the regulators
  - have effective contracting practices and effectively manage their contractors
  - come closer to initial cost and schedule projections
  - have acceptable quality
  - obtain license closer to schedule

DOE/EM Project Performance Study

- DOE Environmental Management Study (Nov 1993)
  - to measure current status of EM project systems
  - provide baseline for measuring improvement

- Scope
  - project development and execution from project definition to construction completion

- Approach
  - compare EM project performance to private industry and other government
  - quantitative comparisons: cost performance, cost overrun, schedule performance, schedule slip
  - analysis controls for differences in project size, type, technology, etc.
  - sixty-five EM projects since 1984 compared to 233 other environmental remediation projects and 951 capital projects

Source: DOE/EM Project Performance Study, 1993

EM Study Results

- **DOE EM Project Systems Performance**
  - DOE costs for equivalent work is significantly higher than industry norms
  - DOE's higher costs are a function of high project management costs and project system practices
  - Cost growth in DOE projects is a result of poor project definition

- **Principal Conclusions**
  - EM project management reactive, not proactive. Team effort diffused and fractioned
  - EM projects have a poor level of project definition
  - DOE uses inappropriate contracting strategies
  - EM projects experience regulatory impacts during the construction phase
  - Cost contingencies for EM projects are not set according to risks
  - From the viewpoint of project fundamentals, the EM system is predicable

Private sector experience indicates that the active engagement of senior management is the critical factor in the success or failure of achieving change and better performance

Source: DOE/EM Project Performance Study, 1993

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EM Study Conclusions

- **Project Definition**
  - Few, if any, standard practices are used for establishing well defined projects
  - Not using the pre-design phase to develop well defined projects
  - Major design changes and regulatory impacts occur more frequently in the later stages of a project's life-cycle, relative to industry or other government
  - Cost contingencies are not related to the degree of project risk

Source: DOE/EM Project Performance Study, 1993

EM Study Conclusions (Cont'd)

- **Project Management**
  - The system appears to have reactive, not proactive, project management
  - No complex-wide project management system controlling and tracking projects on a comparable basis
  - No formal process of sharing "lessons learned" across projects and installations
  - Few dedicated project teams. Team members support multiple projects at the same time which creates priority conflicts
  - EM project teams experience more M&O project manager turnover
  - Project management costs are excessive due, in part, to duplication of effort

Source: DOE/EM Project Performance Study, 1993

EM Study Conclusions (Cont'd)

- **Contracting Strategy**
  - Contracting strategy is not aligned with project risks and/or degree of project definition. Fixed price contracts are used for poorly defined tasks and cost-reimbursable terms are used for better defined tasks
  - Cost growth is greatest on fixed price tasks and the management of change orders is difficult due to decentralized management practices
  - The use of M&O contractors along with on-site A&E firms has further diluted project controls and accountability
  - Project teams have few incentives to ensure well defined projects due to cost-reimbursable contract support

Source: DOE/EM Project Performance Study, 1993

EM Study Conclusions (Cont'd)

- **Regulatory Impacts**
  - One-fourth of EM projects experience significant regulatory impacts during the construction or remedial action phase
  - Nearly all regulatory impacts were a result of a lack of closure on project objectives by the project teams with the regulators
  - For example, several projects failed to demonstrate the feasibility of a remedial approach to state regulators before starting remedial action

Source: DOE/EM Project Performance Study, 1993

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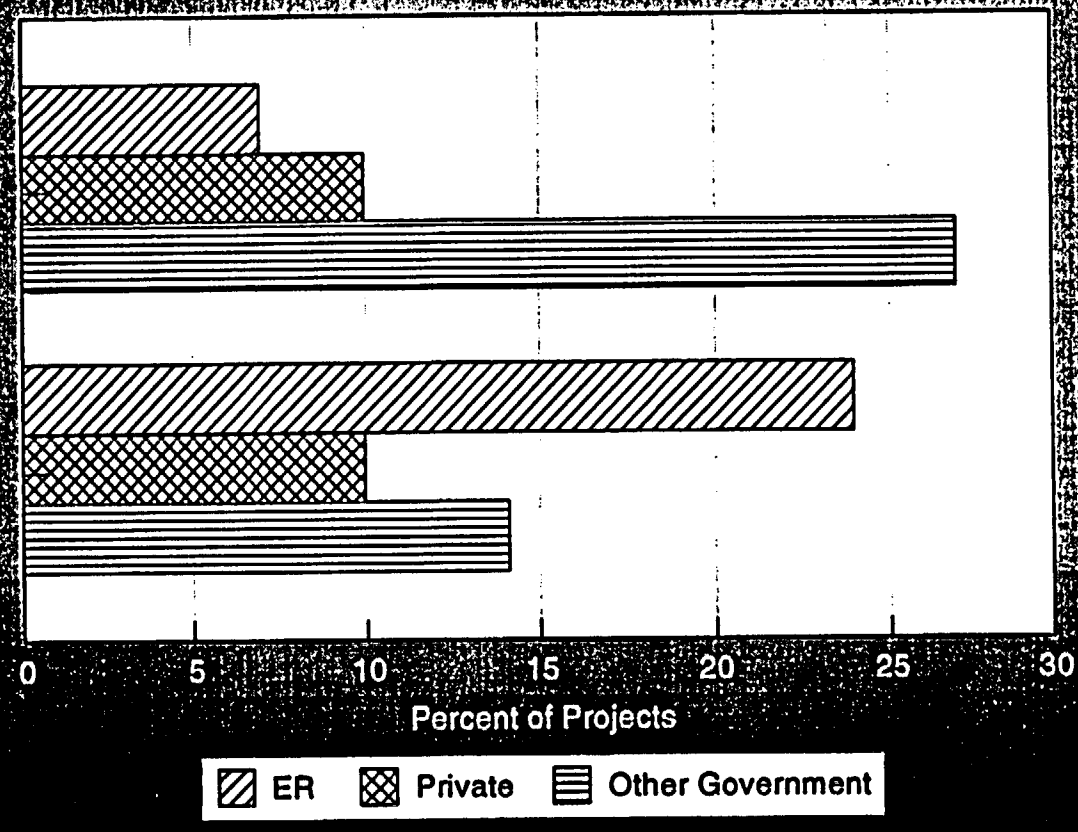
Regulatory Coordination - ER
ER Experiences Regulatory Impacts Late in Cycle



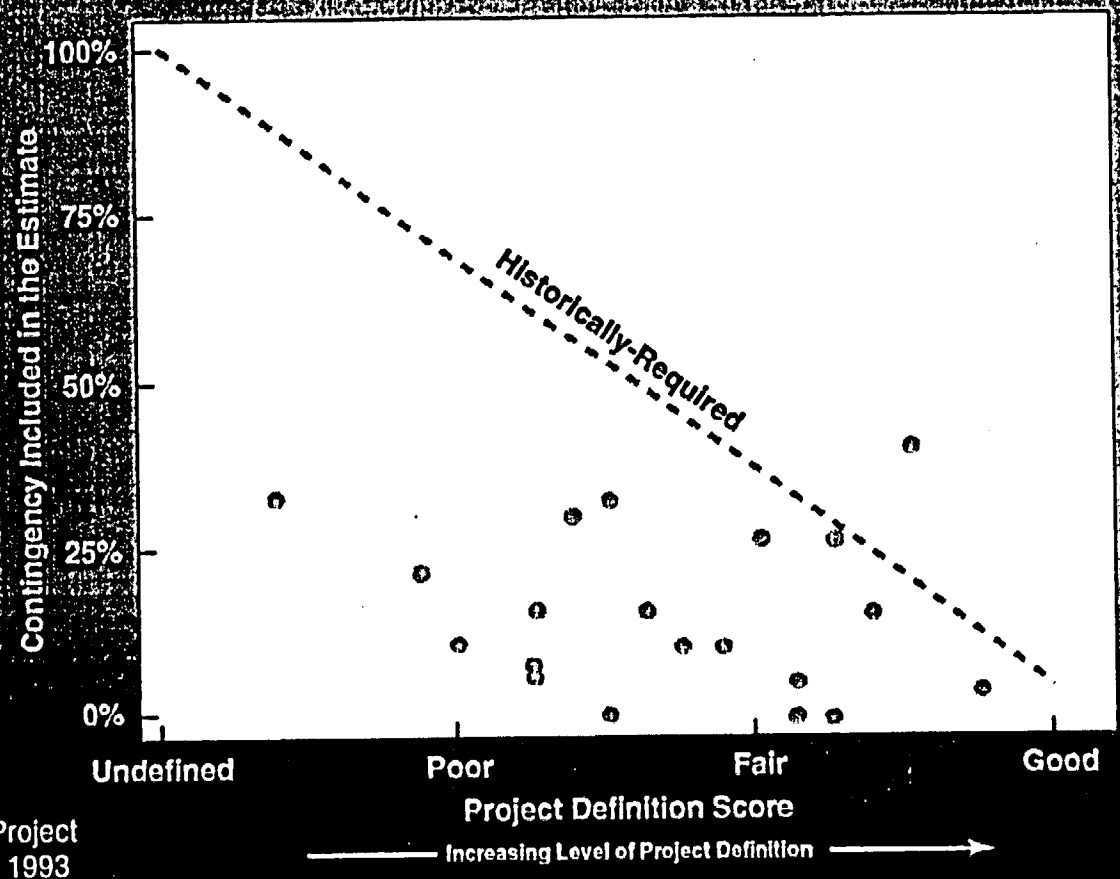
Source: DOE/EM Project Performance Study, 1993

EM Study Conclusions (Cont'd)

- **Cost Contingencies vs Risk**
  - EM project contingencies (at completion of remedial design) are not set on the basis of project definition
  - There is no relationship between the contingency included in the estimate and the level of project definition at the time of the estimate
  - On projects with good or best levels of project definition, contingency estimates range from 0 to 40 percent with no consistent pattern
  - EM contingencies have not been set by project fundamentals
  - Underlying this phenomenon is belief that project costs can be reduced by reducing contingencies. But
    - forcing artificially low contingencies can create deleterious project team behavior
    - hidden contingency leads to higher costs
    - realistic contingencies lead to lower costs
    - realistic low contingencies lead to the lowest cost

Source: DOE/EM Project Performance Study, 1993

ER Estimated Contingencies Are Unrelated to the Level of Project Definition



Source: DOE/EM Project Performance Study, 1993

EM Study Conclusions (Cont'd)

- **Predictability of System**
  - From the viewpoint of project fundamentals, the EM system is predictable
  - The EM system is fundamentally sound as proven by its predictability. Project outcomes are directly related to known causal factors
  - Cost, schedule and needed contingency are all predicable based on key technical and management characteristics
  - When EM projects are prepared and executed with best practices, good results are achieved
  - This means that improvements can be readily implemented

Source: DOE/EM Project Performance Study, 1993

EM Study Conclusions (Cont'd)

- <u>Senior Management Commitment</u>
  - Experience from the private sector has shown that the active engagement of senior management is the critical factor in the success or failure of achieving change and better performance
  - Senior management must demonstrate that they are committed to better performance by initiating action and follow-up on a regular basis to check results
  - Without this commitment, any changes leading to better performance will be short-lived

Source: DOE/EM Project Performance Study, 1993

EM Study Conclusions (Cont'd)

- **Focus on the Causal Factors and Implement Steps for Improvements**
  - Improve project definition prior to the commitment, or authorization of funds
    - Is the project ready to go forward?
  - Improve project management by matching project responsibility with authority. Improve accountability by centralizing management functions and avoiding duplication of effort.
    - Who's decision is it?
  - Improve contracting strategy by aligning incentives with degree of project definition
    - In case of mistakes, who's paying the bill?

Source: DOE/EM Project Performance Study, 1993

EM Study Conclusions vs NUREG-1055 Lessons

	NUREG-1055 LESSON LEARNED							
EM Study Conclusion	Project Mgmt.	Qualification & Experience	Project Team	Contracting Practices	Sr. Mgmt. Commitment	Understanding Regulators	Managing Change	Project Definition
Poor level of project definition						Green	Green	Purple
Project Management weaknesses	Purple	Green	Purple		Green			
Inappropriate contracting strategies	Green		Green	Purple			Green	Green
Regulatory impacts		Green				Purple	Green	Green
Cost contingencies vs risk		Green					Green	Purple
Predictability of system/improvement	Purple			Purple				Purple
Senior management commitment		Green	Green		Purple			

Key: Purple = high correlation Green = lesson helps explain conclusion

ERWM Initiatives

- Stand Down
  - EM wide two days - January 27-28, 1994
  - involved DOE and contractors
  - developed issues/recommendations for improvements

- Example Issues
  - regulatory interaction
  - DOE orders
  - roles, responsibilities and authorities
  - project front end loading
  - project teams
  - project execution/management
  - contracting
  - project management tools

- ORO Pilot Projects
  - like private industry
  - incentive/awards based on performance
  - project team concept
  - strong project manager
  - up front project definition
  - change control

wda-420.21