DOE F 1325.8
(12-84)

United States Government **Department of Energy**

memorandum

JUL -6 P3:07

DATE: JUL 2 - 1987

WM Record File 405

WM Project 1
Docket No.
PDR ✓
LPDR

REPLY TO ATTN OF: RW-20

SUBJECT: HQ/OGR Evaluation of Ford Amendment Study for Application to HQ/OGR Activities

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In Jim Knight's memorandum to my attention, dated December 12, 1986, the necessary HQ/OGR actions to respond to OCRWM's QA Management appraisal of HQ/OGR were outlined. As you may recall, recommendation 4B of the appraisal report proposed a HQ/OGR review and evaluation of the recommendations contained in the Ford Amendment Study (NUREG-1055) so that DOE in our waste management program can avoid the crippling errors in Quality Assurance made by the Nuclear Power industry.

Attached are copies of the following documents:

- Ford Amendment Study, pages 3-6, 3-7, 3-8 and 3-9.
- HQ/OGR presentation, "Applying lessons learned from Nuclear Power QA experience to DOE's Nuclear Waste Repository Program."

I would appreciate your reviewing the two documents and then preparing a written evaluation showing how the lessons learned might be applied to the specific OGR activities for which you are responsible. A group discussion for all OGR managers is scheduled for Wednesday, July 8, 1987, 1:30-2:30 p.m. in Room 5E-069, Forrestal Building. Your comments at this meeting will be recorded and consolidated into an OGR position on how we can apply the recommendations of the Ford Amendment Study to OGR activities.

I appreciate your cooperation.

S. H. Kale

Stephen H. Kale
Associate Director
Office of Geologic Repositories

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NUREG-1055
For Comment

Improving Quality and the Assurance of Quality in the Design and Construction of Nuclear Power Plants

A Report to Congress

Manuscript Completed: April 1984
Date Published: May 1984

W. Altman, T. Ankrum, W. Brach

Division of Quality Assurance, Safeguards, and Inspection Programs
Office of Inspection and Enforcement
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The issue of prior nuclear design and construction experience of key personnel of the project team is related to the issue of prior nuclear construction experience of corporate members of the project team. An inexperienced utility can compensate for its lack of prior corporate nuclear construction experience by hiring key personnel with appropriate prior experience, and by taking other management actions. For a more detailed discussion of this point, see the discussion of the Palo Verde project in Section 3.4. The key study finding on this issue is that while prior nuclear design and construction experience is important for all corporate members of the project team, it is essential for the key project individuals who work for them.

Given that lack of prior nuclear construction experience seems so important to the development of quality problems, it is reasonable to ask what additional insights the Midland project brings to the experience issue. Like PG&E, the owner utility for this project (Consumers Power) had prior nuclear experience. In addition, it selected an experienced A/E, CM and constructor.

Consumers Power has as operating plants Big Rock Point, a small (63 MW) GE-Bechtel turnkey plant that received its operating license in 1962, and Palisades, a medium-size (740 MW) plant designed and constructed for Consumers by Bechtel that went into commercial operation in 1971. In both cases, Bechtel was the A/E, CM and constructor; Consumers assumed an oversight role only and was not actively involved in managing the project. In effect, although Consumers had two operating plants, it had minimal nuclear construction experience, and Bechtel had been in firm control of the earlier projects. The respective roles of Consumers and Bechtel changed for the Midland project. Consumers took a more active management role in the project and Bechtel's management role was proportionately reduced. This was a major change in the roles of each from the prior projects, and it was a change to which neither adjusted quickly. NRC actions by the Midland ASLB hearing board and by the regional office thrust much more project and QA responsibility on Consumers for Midland than had been the case with the earlier plants. Consumers had limited experience within its staff to successfully discharge this responsibility.

A lesson of the Midland project is that while prior nuclear construction experience of each member of the project team may be necessary to avoid the development of quality-related problems and to successfully complete a commercial nuclear power plant in the U.S., experience alone is not sufficient. Many other factors, including management commitment to quality, effective oversight of contractors, qualifications of project staff, and a management attitude that does not view NRC requirements as the ultimate goals for performance, are important also. These and other factors will be discussed in subsequent sections.

3.2.2 Project Management Shortcomings

As suggested above, some utilities' lack of prior nuclear experience contributed to their failure to fully appreciate the complexity and difficulty of building or overseeing the construction of a large nuclear power plant. This inexperience contributed to but is not entirely the cause of several managerial mistakes or shortcomings that led to the quality problems at these four projects.

The principal finding of this study is that nuclear construction projects having significant problems in the quality of design or construction are characterized by the failure to effectively implement a management system that ensures adequate control over all aspects of a project.

To understand why utility management errors and shortcomings are such a dominant contributor to quality problems on construction projects, especially when coupled with lack of nuclear experience, it is useful to understand the underlying philosophy and character of a utility embarking on its first nuclear construction project. The following excerpt from one of the case studies explains one first-time owner's approach to nuclear power:

> Utility Character and Background
>
> Like many utilities, this utility had and has a conservative management philosophy and is adverse to taking unnecessary risks. As with many utilities, this one is quasi monopolistic, being protected from competition by public utility commission policies and practices. With this protection from competition, however, comes close scrutiny from the public utility commission regarding how the utility spends money and handles their finances. These factors contribute, in part, to a cost and schedule consciousness on the part of the utility. For many years the utility's hiring procedures provided for review and approval by several levels of management, including the chief executive officer for all new hires. All their contracts, including those for construction of generating plants, were fixed price contracts.
>
> The utility's prior construction experience consisted of about twenty fossil-fired plants. In some cases the utility had served as construction manager. The utility had a construction department headed by a vice president, which was responsible for all construction utility wide. Over the years the utility developed a close working relationship with, and confidence in, several of the major construction contractors that worked on their fossil projects. The utility's fossil construction success was a source of pride: each plant had come on line on or before schedule and at or within budget. Each plant was of acceptable quality; after a few early bugs were worked out, each plant operated safely and reliably. This quality, incidentally, was something put into the plant by the builders - there was no formal program for quality or the assurance of quality. To the utility, quality was something that happened if you put good people on the project.
>
> Reflecting the generally conservative management philosophy of the company was an adherence to tradition: if something seems to work, stick with it. The traditional way of building fossil plants seemed to be successful, and the company carried over many of its fossil construction practices to its nuclear project; e.g., the utility served as construction manager, and several of their key contractors on fossil plants were retained (although the utility had no nuclear experience and their contractors had

limited nuclear experience); only fixed price contracts were let; the construction department was responsible for construction management except for a few people permanently assigned to the project; personnel from existing departments in the utility were matrixed in to work on the project as needed. They reported administratively and to some degree functionally to their department head, not to the project manager; the project was managed from corporate headquarters with a minimal utility presence at the site; and hiring and recruitment actions continued to be reviewed at the highest levels of the company.

This excerpt applies in varying degrees to the other utilities that had quality problems. In general, these utilities had managed or overseen the construction of several successful fossil projects. They approached their nuclear projects as extensions of the earlier fossil construction activity, i.e., to be managed, staffed, and contracted out in much the same way as fossil projects. The utilities did not fully appreciate or understand the differences in complexity, quality requirements, and regulations between fossil and nuclear projects and tended to treat the nuclear projects mentally and managerially as just another construction project.

One chief executive termed his utility's first planned nuclear plant as "just another tea kettle", i.e., just an alternative way to generate steam (this was before major quality problems arose at his project). Managerially, the utilities fit their nuclear projects into their corporations' traditional project management scheme, which, in retrospect, may not have been well suited for nuclear work. Generally, the utilities' lack of experience in and understanding of nuclear construction manifested itself in some subset of the following characteristics (not all apply to each of the four utilities):

(1) inadequate staffing for the project, in numbers, in qualifications, and in applicable nuclear experience

(2) selection of contractors who may have been used successfully in building fossil plants but who had very limited applicable nuclear construction experience

(3) over-reliance on these same contractors in managing the project and evaluating its status and progress

(4) use of contracts that emphasized cost and schedule to the detriment of quality

(5) lack of management commitment to and understanding of how to achieve quality

(6) lack of management support for the quality program

(7) oversight of the project from corporate headquarters with only a minimal utility presence at the construction site

(8) lack of appreciation of ASME codes and other nuclear-related standards

(9) diffusion of project responsibility and diluted project accountability

(10) failure to delegate authority commensurate with responsibility

(11) misunderstanding of the NRC, its practices, its authority, and its role in nuclear safety

(12) tendency to view NRC requirements as performance goals, not lower thresholds of performance

(13) inability to recognize that recurring problems in the quality of construction were merely symptoms of much deeper, underlying programmatic deficiencies in the project, including project management.

Each of the four utilities had varying degrees of understanding of the project, its complexity, their role in it and how it should be managed. In several cases, utility management did not understand what was required for successful project completion and consequently could not provide effective oversight or leadership of their contractors. In some cases, no one was managing the project; the project had inertia but no guidance or direction. In several cases, the utility's project management approach failed to provide effective oversight of several aspects of the project, including planning, scheduling, procurement, cost control, degree of design completion, and quality. It is important to note that problems in quality and quality assurance were not the only management shortcomings at several of the projects; they fit into a larger pattern that evidences lack of effective overall project management. While some of the four projects studied had experienced extensive management problems, all had had problems implementing the quality assurance program, a key management control program for any complex project. Each nuclear construction project studied that had significant problems in the quality of design or construction was characterized by the failure to effectively implement a management system that provided effective oversight over all aspects of the project.

The pattern described above, which emerged from the four case studies (including the TPT study), fits the Midland project. A 1982 NRC staff report to the ACRS on Midland stated:

> The Region III inspection staff believes problems have kept recurring at Midland for the following reasons: (1) overreliance on the architect-engineer, (2) failure to recognize and correct root causes, (3) failure to recognize the significance of isolated events (4) failure to review isolated events for their generic application, and (5) lack of an aggressive quality assurance attitude.

Each of these five reasons was seen at one or more of the case study projects that experienced quality problems. The applicability of reasons (2), (3), and (4) to the case study projects is discussed in more detail in Section 3.3.

3.2.3 Shortcomings in NRC's Screening of Construction Permit Applications

Previous sections of this report have identified lack of prior nuclear experience and management shortcomings as two primary root causes of the major problems that led to this study. Given these findings, it is reasonable to ask