March 12, 1981

SECY-81-161

POLICY ISSUE
(Information)

FOR: The Commissioners

FROM: William J. Dircks, Executive Director for Operations

SUBJECT: USE OF INDEPENDENT DESIGN REVIEWS (IDR's) IN THE REGULATORY PROCESS

PURPOSE: To inform the Commission of NRR's use of independent design reviews in the regulatory process.

DISCUSSION: At a January 1980 IEEE/NRC jointly sponsored conference, Working Conference on Advanced Electrotechnology Applications to Nuclear Power Plants, a design review process as used by NASA Goddard Space Flight Center was described. During that meeting the feasibility of applying such a system review management technique (therein referred to as Independent Design Reviews) to the licensing review of nuclear power plants to enhance reliability and safety was endorsed (Enclosure 1). IDR is a systematic, technically-oriented, and documented evaluation of a system and associated equipment against requirements by a team of independent specialists. Although many utilities perform initial reviews of designs provided by the NSSS vendor and the AE; these reviews are not usually rigorous evaluations against criteria nor are they documented.

The use of an IDR is seen as having two major benefits. First, it involves the applicant, who will ultimately operate the nuclear facility, in a detailed safety evaluation of the facility against the NRC regulations which results in a greater extent of understanding than that gained in the current process. Second, it results in potential manpower savings to the NRC.

Contact:
Frank Miraglia, NRR
X29779

Since a severe resource shortage exists for OL casework in NRR over the next few years , NRR has been examining ways to improve the efficiency in the licensing process. Our experience to date with the IDR process is encouraging and it appears that IDR's have the potential for mitigating some of the expected resource shortfall in NRR. The staff has been using Mr. Herman LaGow a former NASA consultant, to assist in developing IDR guidelines. Mr. LaGow has been participating in the actual IDR's conducted to date.

Specifically, NRR has begun, with Arizona Public Service Company, in the conduct of (IDR's) of selected systems of the Palo Verde project (DC Power Systems, AC Power Systems, Auxiliary Feedwater Systems and Equipment Qualification Systems). The objective of these reviews was to determine the adequacy of these systems with regard to compliance with Commission requirements. A brief summary of the initial efforts is contained in Enclosure 2. A summary of the procedures utilized in the conduct of these meetings is contained in Enclosure 3.

Basic guidelines have been developed to assure effective use of the process by applicants and by NRR. OELD has been involved to assure that the process would provide an adequate basis for the staff's positions at a hearing. Based on the experience gained to date in the conduct of these meetings, the staff is making several modifications to the current procedures to enhance the effectiveness of these reviews to ensure that these procedures can be incorporated into the regulatory review process (See Enclosure 4).

NRR plans to continue the experimental use of IDR's along the approach that follows:

1. Carefully direct the potential uses of the IDR process to areas where the Palo Verde reviews have proven to be productive.

2. Develop implementing procedures, along the lines discussed in Enclosure 4, which will increase NRC participation in the front-end of the IDR process.

3. Present seminars to NRR staff on the IDR concept to ensure a well-understood and disciplined process.

4. Brief the ACRS on the IDR process and discuss experience to date.

5. Monitor and evaluate the use of IDR's in the licensing process.

William J. Dircks, Executive Director
for Operations

Enclosures:
1. IEEE/NRC Mtg. Excerpt
2. Summary of Palo Verde IDR's
3. IDR Procedures Used to Date.
4. Use of Independent Design Reviews in Regulatory Process

DISTRIBUTION
Commissioners
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Exec Dir for Operations
ACRS
Secretariat

ENCLOSURE 1

SYSTEMS MANAGEMENT TECHNIQUES PANEL

Co-chairing the Systems Management Techniques panel were Harold R. Denton and Edward A. Wolff. Dr. Denton is director of the Office of Nuclear Reactor Regulation at the Nuclear Regulatory Commission, a position he has held since 1978. Since joining the commission eighteen years ago, he has held increasingly responsible positions in the licensing and inspection programs. Dr. Wolff is project study manager at the NASA Goddard Space Flight Center, Greenbelt, Maryland, a post he has held since 1978. Dr. Wolff has served as a director of IEEE and has had extensive participatory experience in various boards of IEEE.

Rapporteur: Stuart Peale

Panelists and Participants are listed at the end of this report.

INTRODUCTION

The objective of the Systems Management Techniques Panel was to explore the feasibility of applying a system review management technique to the design, acquisition, construction, and operation of nuclear power plants to enhance reliability and safety.

Participants in the panel consisted of technologists with a working knowledge of system review techniques, members of the staff of the Nuclear Regulatory Commission, and people from the nuclear industry, primarily utilities.

The system review technique, which was the subject of this panel's deliberation, was described to the entire conference by Herman LaGow (see Part 2).

In order to give the panel a head start in exploring the practicality of the technique, a brainstorming session was held a month in advance with some of the technology and the NRC panel participants. This brainstorming produced a strawman implementation scenario, an anlaysis of that scenario, and strawman prioritization criteria for use in comparing different scenarios to be developed at the conference. Also prior to the conference, the participants were sent a homework assignment. The participants were asked to read and study this material to be better prepared for panel deliberations.

PANEL DISCUSSIONS

The panel's session began with introductions by the participants. This was followed by adoption of an agenda for the panel. The initial panel discussions focused on the exchange of information among the technologists, the industry participants, and the regulators to enable the participants to understand the problems faced by the three groups. The technologists described the way the review technique and associated techniques are used to reduce problems in the acquisition of reliable aerospace and defense equipment. The industry representatives described the difficulty of acquiring and operating nuclear power plants when the design guidelines are constantly changed to take advantage of the experience acquired. The regulators described the statutory and political requirements to assure a high degree of safety in nuclear power.

Once the exchanges of information and identifications of problems were completed, the panel turned its attention to strawmen scenarios of how a review technique might be practically applied to power plant design, construction, and operation. The creation of these strawmen was facilitated by the fact that several participants completed the homework assignment and brought their work to the conference, where it was reproduced and distributed.

Early in the discussion the technologists learned to substitute the word "plant" for "systems" in describing the review technique, since the industry uses the word "system" to describe what the technologist calls a "subsystem."

Following the discussion of strawman scenarios, the panel discussed the advantages and disadvantages of the plant review process. The original strawman list was slightly modified and then expanded. The final list of advantages and disadvantages was developed. By this time, there was a general consensus that Strawman Scenario 3 was preferred.

RECOMMENDATIONS

Finally, the panel considered recommendations that could be made and found it had a consensus on what should be recommended. These unanimous recommendations are given below.

1. There should be an interdisciplinary plant review process, as described by Strawman Scenario 3 (see following description).

2. NRC should examine what parts of existing procedures can be simplified or eliminated when review is implemented.

3. There should be a task force to expand Strawman

Scenario 3 into a total system management concept that accommodates the nuclear business: (a) Involve systems people and nuclear people; (b) Task force should visit installations; (c) Should be considered by Atomic Industrial Forum/TMI oversight committee.

4. There should be an exercise between utility and aerospace systems people to see how the process might be applied in one case. This will be pursued by NRC.

STRAWMAN SCENARIO 3: IMPLEMENTATION

1. There is a utility Plant Review Manager who reports to a Corporate Officer. There is an NRC Plant Review Manager who reports to NRC Management.

2. The plant reviews are divided into the following phases:

Phase 1: Initial Requirements through operating license (OL).

Phase 2: Plant operations (annually).

Phase X: Miscellaneous review by NRC.

Phases 1 and 2 are conducted by the utility with the NRC Review Manager as observer.

Phase X is held when NRC is dissatisfied with Phase 1 or 2 reviews.

Presenters are utility and contractor people.

3. The Plant Review Manager recommends whether plant—(specification adequate, conceptual design adequate, final design adequate, construction plan adequate, test plan adequate, test adequate, operation plan (including contingency and emergency plan) adequate—is operationally ready.

The construction permit (CP) is issued after Phase 1 critical design review (CDR) and the OL issued after final Phase 1 review.

4. The Plant Review Manager has authority to select team members from various disciplines (mechanical design, structures, materials, geology, for example) and organizations (projects, inspection and enforcement, INPO, legal, FEMA, state regulator, utility management).

5. Review Format: Utility project presents to review team according to agenda set by review manager at times and places set by review manager. Actual designers will present to design reviews.

6. The review encompasses the entire life cycle of the plant.

7. Objectives, Review criteria:

Plant will satisfy success criteria of owner/financer and NRC (Safety). NRC criteria fixed at CDR.

STRAWMAN SCENARIO 3: ANALYSIS OF ADVANTAGES AND DISADVANTAGES

ADVANTAGES

Provides earlier identification of problems.

Provides forum for communicating past experience in timely fashion.

Helps optimize design and avoid pitfalls.

Assures interdisciplinary and inter-organization interaction.

Insures important safety functions adequately designed and tested.

Provides written record of extensive effort to assure safety.

Provides independent advice to decision makers.

Provides prompt, in-depth review of project at each step.

Can increase NRC confidence in safety and reduce other regulatory burdens.

Will reinforce other contributions to safety, including thorough use of past experience and adequate test programs.

Record can reduce legal liability.

Require matrix management at NRC.

Helps define real safety issues.

DISADVANTAGES

Costs utilities money.

Requires regulatory or procedural change.

Requires bolstering NRC technical staff.

Could lead to excessive layers of review.

Reviews are open to the public.

ROSTER OF PARTICIPANTS

Dan E. Andrews, Jr.

W. Howard Arnold

Robert M. Butler

C.W. Childs

Dr. Harold R. Denton

Richard M. Eckert

T.N. "Tom" Ewing

James Green

Walter P. Haass

D.W. "Chuck" Halligan

Leonard Jaffe

Leonard J. Koch

Herman E. LaGow

William J. Linblad

C.O. Miller

Warren Owen

William R. Pogue

Cordell Reed

Denny Ross

Joseph F. Shea

Rudolph A. Stampfl

Edward A. Wolff

Co-Chairing the Systems Management Techniques Panel were Harold R. Denton and Edward A. Wolff. Dr. Denton is director of the Office of Nuclear Reactor Regulation at the Nuclear Regulatory Commission, a position he has held since 1978. Since joining the commission eighteen years ago, he has held increasingly responsible positions in the licensing and inspection programs. Dr. Wolff is project study manager at the NASA Goddard Space Flight Center, Greenbelt, Maryland, a post he has held since 1978. Dr. Wolff has served as a director of IEEE and has had extensive participatory experience in various boards of IEEE.

SYSTEMS MANAGEMENT TECHNIQUES

Co-Chairman:

Dr. Harold R. Denton
Director, Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Dr. Edward Wolff
Project Study Manager
Goddard Space Flight Center

Rapporteur: Stuart Peale, IEEE Staff

Panelist:

Dr. Dan Andrews
Naval Ocean Systems Center

Dr. Joe Shea
Raytheon Company

Mr. Robert Arnold
General Public Utilities

Mr. Rudi A. Stampfl
Naval Air Development Center

Mr. Herman LaGow
Consultant
Goddard Space Flight Center

1. INTRODUCTION

The objective of the Systems Management Techniques Panel was to explore the feasibility of applying a system review management technique to the design, acquisition, construction, and operation of nuclear power plants to enhance reliability and safety.

Participants in the panel consisted of technologists with a working knowledge of system review techniques, members of the staff of the Nuclear Regulatory Commission, and people from the nuclear industry, primarily utilities. These participants are shown in Table 1.

The system review technique that was the subject of this panel's deliberation was described to the entire conference by Mr. Herman LaGow. (See Table of Contents of this Conference Record.) This description of the technique as it is implemented at the NASA Goddard Space Flight Center is summarized in Table 2.

In order to give the panel a head start in exploring the practicality

of the technique, a brainstorming session was held a month in advance with some of the technology and NRC panel participants. This brainstorming produced a strawman implementation scenario, an analysis of that scenario, and strawman prioritization criteria for use in comparing different scenarios to be developed at the conference. The strawman scenario is shown in Table 3, the analysis in Table 4, and the prioritization material in Table 5.

Prior to the conference, the participants were sent a homework assignment. An instruction sheet for this assignment is given in Table 6. Attached to Table 6 were Tables 2 through 5. The participants were asked to read and study this material to be better prepared for panel deliberations.

TABLE 1
SYSTEMS MANAGEMENT TECHNIQUES PANEL PARTICIPANTS

Dan E. Andrews, Jr.
Naval Ocean Systems Center

W. Howard Arnold
Westinghouse/Nuclear International

Robert M. Butler
Boston Edison

C.W. Childs
Risk Management Association

Harold R. Denton
Nuclear Regulatory Commission

Richard M. Eckert
Public Service Electric & Gas Co.

T. N. "Tom" Ewing
Public Service Company of Oklahoma

Jim Green
Tennessee Valley Authority

Walter P. Haass
Nuclear Regulatory Commission

D. W. "Chuck" Halligan
Bechtel Power

Leonard Jaffe
NASA, Pres. TMI Commission Staff

Leonard J. Koch
Illinois Power Company

Herman E. LaCow
Systems Consultant

William J. Linblad
Portland General Electric

C. O. Miller
System Safety, Inc.

Warren Owen
Duke Power Company

William R. Pogue
Public Service Company of Oklahoma

Cordell Reed
Commonwealth Edison

Denny Ross
Nuclear Regulatory Commission

Joseph F. Shea
Raytheon Company

Rudolph A. Stampfl
Naval Air Development Center

Edward A. Wolff
NASA

TABLE 2. SYSTEMS REVIEW TECHNIQUE

MANAGEMENT INSTRUCTION

TITLE: SPACECRAFT DESIGN REVIEW PROGRAM

1. PURPOSE

This instruction defines the policy and general procedures for the design review of projects at Goddard Space Flight Center.

2. APPLICABILITY

The provisions of this instruction are applicable to all GSFC spacecraft projects, including experiments and unique support equipment.

3. DEFINITION

Design Review is a systematic, technically oriented, and documented evaluation of spacecraft and associated equipment by a team of specialists.

4. RESPONSIBILITIES

a. The Director of Systems Reliability has overall responsibility for the Spacecraft Design Review Program (SDRP), and will appoint the members and Chairman of each Design Review Team (DRT) by memorandum.

b. The Chief, Systems Review Office is responsible for implementing and executing design reviews and generating design review plans and procedures.

5. POLICY

a. All GSFC spacecraft and major flight experiments shall be subject to the SDRP.

b. The SDRP shall be supported by all GSFC Directorates who will furnish the DRT with senior personnel experienced in the required technical disciplines.

6. DESIGN REVIEW OBJECTIVES

Primary objectives of the SDRP is to enhance the probability of success of GSFC spacecraft missions. This objective will be achieved by bringing to bear on each project the cumulative knowledge of a team of engineers and scientists who have had extensive prior experience with the particular types of systems and functions involved. While the design review is technically oriented, proper consideration will be given to

constraints operating on the projects, particularly those involving primary mission objectives and program costs and schedules. These reviews shall assure that each project has the benefit of Centerwide experience gained on other projects. They shall also provide the Center's review of the projects' Sysems Safety Program.

7. STRUCTURE AND FUNCTION OF THE DESIGN REVIEW TEAM MEMBERSHIP

a. The Design Review Team
The DRT will include personnel experienced in design, systsems engineering and integration, reliability, quality assurance, testing, materials, and other applicable disciplines. The personnel will be selected from throughout the Center with the approval of the appropriate Directors.

b. Number of Reviews

(1) The Chief, Systems Review Office, Systems Reliability Directorate, in conjunction with the individual Project Manager will develop a total design review plan. Except in cases of repeat missions, the following reviews will normally be held:

(a) Design Reviews - these reviews occur during the design phase and prior to the start of assembly. They will emphasize implementations of design approaches resulting from the study phase as well as test plans for the prototype and flight systems. For new systems, generally two design reviews will be conducted.

(b) Environmental Review - this review occurs after prototype qualification testing, or prior to acceptance testing, if no prototype is used. The primary purpose of this review is to determine the qualification status of the hardware and to evaluate flight acceptance test plans.

(c) Flight Readiness Review - this review will usually take place prior to shipment of the flight spacecraft to the launch range, and will concentrate on spacecraft performance during acceptance testing.

(d) Flight Operational Readiness Review - this review will be conducted when a flight operations plan is available. While all of the previous reviews involve operations, this review will emphasize the final orbital operations plans, as well as the compatibility of the spacecraft with ground support equipment and ground network, including summary results of the network compatibility tests.

(2) Major flight experiments which are required for mission success are subject to this review program. One or two Experiment design reviews, depending on need, shall be held prior to integration.

c. Design Review Schedule
The several reviews will be conducted on a schedule determined by the Chief, Systems Review Office after consultation with the individual Project Manager. The major reviews shall be depicted in the GSFC Project Management Information Control report (PMIC).

d. Documentation

(1) At the completion of each review a formal report to the Deputy Director, GSFC will be prepared by the DRT. Minimum requirements of the report are:
   (a) a summary statement of the DRT findings;
   (b) recommendations made by the DRT to the project; and
   (c) comments or responses of the project to the findings and recommendations of the DRT.

(2) The completed design review report will contain the results of each review conducted for the project together with a mission launch readiness statement issued by the Chairman of the DRT.

(3) The design review report will be issued and formally accepted by the Deputy Director, GSFC, prior to the launch operation.

NUCLEAR POWER PLANT SYSTEM REVIEW

TABLE 3 STRAWMAN IMPLEMENTATION SCENARIO #1

1. System Review Manager reports to NRC (Chairman, EDO, Dir. NRR)
2. System review manager recommends whether plant (spec. adequate, conceptual design adequate, final design adequate, construction plan adequate, test plan adequate, test adequate, operation plan (including contingency and emergency plan) adequate, operationally ready, (prepared for control operator)
3. System Review Manager has authority to select people (team members) from various disciplines. (Mechanical design, structures, materials, geology, hydrology, meteorology, reactor systems, core design, containment systems, auxilliary systems, human factors, operational experience, instrumentation & control, electrical design, reliability, quality assurance, radiation protection, chemistry, management controls, testing, security, procedures, training, safety, control room operators). And organizations (projects, inspection and enforcement, INPO, legal, FEMA, state regulator, utility management).
4. Review Format: Utility project presents to review team according to agenda set by review manager at times and places set by review manager. Actual designers will present to design reviews.
5. Review Criterion: Will the project satisfy the NRC success criteria?

TABLE 4 INITIAL ANALYSIS OF STRAWMAN IMPLEMENTATION SCENARIO #1

Nuclear Power Plant Systems Review

Advantages	Disadvantages
Provides earlier identification problems	Costs utilities money
Provides forum for communicating past experience in timely fashion	Requires regulatory or procedural change
Helps optimize design and avoid pitfalls	Requires bolstering NRC Technical Staff
Assures interdisciplinary and interorganizational interaction	Requires matrix management at NRC
Insures important safety functions adequately designed and tested	
Provides written record of extensive effort to assure safety	
Provides independent advice to decision makers.	
Provides prompt, in-depth review of project at each step.	

TABLE 5 PRIORITIZATION CRITERIA TO COMPARE DIFFERENT IMPLEMENTATION SCENARIOS - NUCLEAR POWER PLANT SYSTEM REVIEW

1. Contributes to safety.
2. Contributes to reliability.
3. Provides independence of thought.
4. Provides efficient use of resources.
5. Requires a minimum of new legislation or rule change.
6. Provides a record of NRC overview.

TABLE 6 HOMEWORK ASSIGNMENT

This panel will focus on techniques for the review of the management of a project from early concept design to final operation. Of special interest are management techniques to insure that all aspects of a system are integrated to produce a safe system. Such techniques have been successfully employed by the NASA to take a project from initial specification through the final launch of a satellite using panels of experts to insure that all technologies have been adequately integrated through a continuing review of systems management. Experts in system review techniques are needed to share the most successful management techniques with regulators and nuclear power plant leaders to determine the practicality of applying such techniques to resolving issues in nuclear power plant safety.

Attached is a description of how the system review technique is implemented at the NASA Goddard Space Flight Center (Management Instructor GMI 8010.1B).

Attachment 1. This is an example of the System Review Concept that the planel will try to apply to the nuclear power plant problem.

You are asked to review, critique, and create other options for the following enclosed items:

1. The Strawman Implementation Scenario - Attachment 2. This describes one way the concept could be implemented for the nuclear power plant safety problem.
2. The Analysis of the Strawman Implementation Scenario Attachment 3.
3. The Prioritization Criteria to compare different Implementation Scenario - Attachment 4.

Please bring your homework to the conference registration desk on January 15 so it can be reproduced and distributed to your fellow panel members at the start of the deliberation.

2. PANEL DISCUSSIONS

The panel's session began with introductions by the participants. This was followed by adoption of an agenda for the panel, shown in table 7.

The initial panel discussions focused on the exchange of information among the tecnologists, the industry, and the regulators to enable the

participants to understand the problems faced by the three groups. The technologists described the way the review technique and associated techniques are used to reduce problems in the acquisition of reliable aerospace and defense equipment. The industry described the difficulty of acquiring and operating nuclear power plants when the design guidelines are constantly changed to take advantage of the experience acquired. The regulators described the statutory and political requirements to assure a high degree of safety in nuclear power.

Once the exchange of information and identification of problems was completed, the panel turned its attention to strawmen scenarios of how a review technique might be practically applied to power plant design, construction, and operation. Additional strawmen implementation scenarios suggested during the brainstorming are shown in Tables 8 through 11. The creation of these strawmen was facilitated by the fact that several participants completed the homework assignment and brought their work to the conference where it was reproduced and distributed.

Early in the discussion the technologists learned to substitute the word "plant" for "systems" in describing the review technique, since the industry uses the word "system" to describe what the technologist calls a "subsystem."

TABLE 7 SYSTEMS MANAGEMENT TECHNIQUES PANEL AGENDA

1. Introductions
2. Explanation of Nuclear Regulation
3. Clarification of NASA System Review Technique presented in open session
4. Presentation of other variations of system review (DOD, etc.)
5. Brainstorming: Development of possible feasible implementation scenarios
6. Analysis of scenarios (advantages and disadvantages)
7. Development of scenario prioritization criteria
8. Scenario prioritization
9. Recommendations: Is any future action desirable? (study, larger more intensive panel, experiment)
   Recommended plan for any future action
10. Preparation of Panel report

TABLE 8 STRAWMAN IMPLEMENTATION SCENARIO #2

1) Plant review manager in utility reports to V.P. of Nuclear Production or V.P. of Engineering/Construction
2) - 4) Same as Strawman #1

TABLE 9 STRAWMAN IMPLEMENTATION SCENARIO #3

1) Plant Review Manager reports to a Corporate Officer
2) NRC Review Manager reports to NRC Management
3) Phase 1: Initial Requirements through operating license (OL)
   Phase 2: Plant operations (annually)
   Phase X: Miscellaneous review by NRC
4) Phases 1 & 2 by utility with NRC Review Manager asobserver

Phase X when NRC dissatisfied with Phase 1 or 2 reviews
Presenters are utility and contractor people

5) Construction Permit (CP) issued after Phase 1 critical design review (CDR) OL issued after Phase 1 review

6) Objectives: Review criteria: Plant will satisfy success criteria of owner/financer and NRC (Safety). NRC criteria fixed at CDR.

7) Review encompasses entire life cycle

8) Includes items 2, 3, and 4 of Strawman #1

TABLE 10 STRAWMAN IMPLEMENTATION SCENARIO #4

1)	Specification of mission	U
2)	Specification of Risk; characteristic design goals	N
3)	Interaction of Mission with Risk Characteristic	U,N
4)	Specification of Risk Evaluation Methodology	U,N
5)	Preliminary Design Criteria Agreement FREEZE 1	U,N
6)	Preliminary Design (CP)	U,N
7)	System Interaction Review; iterate; pre-OL (NEW) - FREEZE 2	U,N
8)	Final Design Review Againsts Criteria	U,N

TABLE 11 STRAWMEN IMPLEMENTATION SCENARIO

After the construction permit the utility reviews experience annually and assesses changes required for safety.

Following the discussion of strawman scenarios, the panel discussed the advantages and disadvantages of the plant review process. The original strawman list of Table 4 was slightly modified and then expanded. The final list of advantages and disadvantages is given in Table 12. By this time, there was a general consensus that Strawman Scenario #3 was preferred.

3. CONCLUSIONS

Finally, the panel turned to the final item of the agenda of Table 7 and considered recommendations that could be made.

The panel found it had a consensus on what should be recommended. These unanimous recommendations are given in Table 13.

TABLE 12 ANALYSIS OF STRAWMAN IMPLEMENTATION SCENARIO #3

Nuclear Power Plant Systems Review

Advantages	Disadvantages
Provides earlier identification of problems	Costs utilities money
Provides forum for communicating past experience in timely fashion	Requires regulatory or procedural change
Helps optimize design and avoid pitfalls	Requires bolstering NRC technical staff

Assures interdisciplinary and interorganizational interaction	Could lead to excessive layers of review
Insures important safety functions adequately designed and tested	Reviews are open to the public
Provides written record of extensive effort to assure safety	
Provides independent advice to decision makers	
Provides prompt, in-depth review of project at each step	
Can increase NRC confidence in safety and reduce other regulatory burdens	
Will reinforce other contributions to safety, including thorough use of past experience and adequate test programs	
Record can reduce legal liability	
Requires matrix management at NRC	
Helps define real safety issues	

TABLE 13 RECOMMENDATIONS

1. There should be an interdisciplinary plant review process, as described by Strawman #3 (See Table 9).
2. NRC should examine what parts of existing procedures can be simplified or elimlinated when review is implemented.
3. There should be a task force to expand Strawman #3 into a total system management concept that accommodates the nuclear business.
   a. Involve systems people and nuclear people
   b. Task force should visit installations
   c. Should be considered by Atomic Industrial Forum/TMI oversight committee
4. There should be an exercise between a utility and aerospace systems people to see how the process might be applied in one case. This shall be pursued by NRC.

ENCLOSURE 2

Summary of Independent Design Review Meeting For Selected Systems Conducted by Arizona Public Service

In all meetings held to date, the design review board was composed primarily of Arizona Public Service (APS) engineering staff members along with representatives of other organizations (e.g., Bechtel, CE, EPRI, NRC). Ed Van Brunt, Jr., APS Vice President of Nuclear Projects, has been the Board Chairman for all of the meetings. A formal presentation of the system under review was made in each case by Bechtel. The board members asked questions of Bechtel throughout the meeting. Questions which could not be answered were included on a list of open items which Bechtel committed to respond to in writing at a later date. A stenotypist has been available at all meetings so that transcripts of the proceedings can be made available. The following are brief summaries of the previous four meetings.

DC Power System Review

Meeting Date and Place: May 8, 1980 - Phoenix, Arizona
NRC Observer: F. Rosa
Submittals Available:

- 06/04/80 - Meeting Transcript
- 06/30/80 - Bechtel Response to Board Open Items
- 09/04/80 - Additional Board Questions to Bechtel
- 09/18/80 - Bechtel Response to Additional Board Questions
- 10/14/80 - APS Close-out Letter
- 12/22/80 - SER input received

A summary of this meeting is discussed in a trip report dated June 2, 1980 from F. Rosa to D. Ross. Basically, F. Rosa stated that the Bechtel team was questioned intensively on all aspects of the design and he felt that the Board Questions were essentially equivalent to the NRC First Round Questions.

The Power Systems Branch (PSB) stated in a memo from Paul Check to R. Tedesco on December 22, 1980 that a time saving of approximately 10% was realized in the preparation of the SER input. The SER received from PSB had only two minor open issues.

AC Power System Review

Meeting Date and Place: July 8, 1980 - Bethesda, Md.
NRC Observer: F. Rosa
Submittals Available:

- 09/11/80 - Meeting Transcript
- 12/09/80 - Bechtel Initial Response to Board Open Items
- 02/10/81 - Bechtel Final Response to Board Open Items; APS Close-out letter

Estimated SER Input date: April 6, 1981

This meeting began with a general discussion of the overall system. Bechtel then described at length the manner in which the system meets NRC requirements and CESSAR interface requirements. The third topic covered was a description of the instrumentation and controls for the diesel generators.

Auxiliary Feedwater System Review

Meeting Date and Place: August 21-22, 1980 - Phoenix, Arizona
NRC Board Members: O. Parr
J. Wermiel
Submittals Available:
10/17/80 - Meeting Transcript
Expected Close-Out Date: Mid-April, 1981
Estimated SER Input Date: Early-May, 1981

The format of this meeting was essentially the same as the AC power systems meeting, i.e., a general overview of the system followed by a discussion on the manner in which the system meets NRC and CESSAR interface requirements. NRC representatives were, for the first time, included on the panel as board members. This was also the first meeting in which it was concluded that the system did not meet one of NRC's positions on system design. This aspect of the design was classified as an "Open Item" requiring further Bechtel investigation and resolution. Upon receipt of Bechtel's response, the NRC staff will determine whether any design modifications are necessary.

Equipment Qualification System Review

Meeting Date and Place: September 25-26, 1980 - Phoenix, Arizona
NRC Board Members: Z. Rosztoczy
V. Noonan
Submittals Available:
12/05/80 - Meeting Transcript
Expected Close-Out Date: April, 1982
Estimated SER Input Date: April, 1982

Bechtel described the method that they are using to assure that the installed equipment will be qualified both environmentally and seismically. The NRC board members were active participants in this meeting. The other board members did not appear to be intimately familiar with NRC requirements in this area. Bechtel expects to have all required supporting documentation available by April 1982, at which time NRC can complete its final audit.

ENCLOSURE 3

Enclosure 3

CURRENT PROCEDURES USED TO DATE IN PALO VERDE SYSTEM DESIGN REVIEW OF SELECTED SYSTEMS

There have been four Palo Verde design review meetings (IDR's) held to date. The following describes the procedures that have and are currently being used in the conduct of these meetings.

PROCEDURES

1. System to be reviewed is selected.

2. Applicant chooses panel members and sets meeting date. A senior management representative of the applicant acts as chairman of the review panel.

3. NRC Project Manager issues meeting notice and contacts the NRC review branches that should be involved.

4. Cognizant NRC reviewers are chosen to participate as panel members. Other NRC attendees participate as observers.

5. A draft meeting agenda is sent to NRC by the applicant for review and concurrence. The finalizing of the agenda normally involves meetings or telecons between NRC and the applicant.

6. Conduct of the meeting:
   a) The AE or Vendor makes a presentation to the panel. The presentation begins with a general system overview followed by a discussion by the AE or Vendor on the manner in which the system meets applicable NRC and applicant requirements.

   b) Questions are asked by the panel during pre-selected time periods. Questions that cannot be answered by the AE or Vendor are listed as open items by the panel. All open items are read by the chairman at the end of the meeting to avoid any later misunderstandings.

   c) A transcript of the proceedings is kept.

   d) Handouts of the slides are given to all panel members.

   e) All meetings are open to the public and most take place in the vicinity of the plant site.

7. The transcript is formally submitted to NRC and sent to all panel members after proof-reading by the applicant. This normally takes 6-10 weeks.

8. The AE or Vendor submits its responses to applicant, who then formally submits these responses to NRC. These responses are also sent to all panel board members who are asked for additional comments. This process has resulted in one or two rounds of questions by the review panel to the AE or Vendor.

9. The applicant submits to NRC a letter stating that all issues have been resolved to the panel's satisfaction.

10. The staff writes an SER, based on its attendance during the panel review, the transcript of the review meeting and the resolution of the issues identified by the review panel.

ENCLOSURE 4

Use of Independent Design Reviews in the Regulatory Process

Enclosure 4

Objective

The principal objective of an independent design review in the regulatory process is to determine that the system under review meets the applicable regulatory design criteria. The mechanism for achieving this objective is through the use of a technically competent team of specialists. Such a design review process is consistent with the requirements of Section III of Appendix B of 10 CFR Part 50.

Advantages

. Enhance the design and operation of nuclear power plants
  - Inter-disciplinary review ensures the adequate design and testing of safety systems
  - Provides forum for relating past experience in review
  - Provides for early identification and resolution of problems
  - Provides for an independent review of design
. Increase the involvement of the applicant (utility) in establishing the basis or demonstrating compliance with NRC safety regulations.
  - Responsibility always rested with utility, the conduct of IDR by the utility can increase NRC's confidence in the safety of the design
. Streamline the Licensing Process
  - Can result in early SER input for certain disciplines

- Can result in a more in-depth audit of safety system with minimal expenditure in resources

Disadvantages

. Added costs to applicants/utility

. May require regulatory change (rules and practices)

. May require additional NRC senior technical staff

Assessment of Experience to Date

Based on the four design reviews conducted on the Palo Verde project to date it appears that the safety of the systems reviewed will be enhanced. For the systems reviewed it appears that some reduction of resources and time to complete the NRC review will be realized. The comments of the NRC participants in the four IDR's regarding their views for improving the process has been requested. The consensus view of the staff participants in these IDR's was very positive. In most areas of review the staff participants indicated the applicant's review board were technically competent and provided a thorough review of the subject matter. It appears that SER inputs will be able to be prepared by the staff participants based on the IDR meetings and subsequent documentations. SER input on D. C. power systems has been completed and it is estimated that use of the IDR process resulted in a 10% savings in staff resources. However it is not clear at this time whether NRC staff resources will be reduced in all review areas.

The use of the IDR concept was used in the safety evaluation of the San Onofre Unit 1 steam generator sleeving operations. This evaluation was written by the staff primarily on the IDR conducted by the applicant. This IDR involved a number of disciplines (materials engineering, mechanical engineering and radiation protection) and the consensus view of staff participants was very positive. We have been informed that the conduct of participants was very positive. We have been informed that the conduct of the IDR meeting cost the utility approximately $150,000 dollars.

The successful use of the IDR technique in the regulatory process will not be completely demonstrated until the product of these reviews is tested in all phases of the process (i.e., the technique will produce an SER that would be acceptable through the ACRS and hearing process to licensing).

Recommendations to Achieve the Potential of IDR's in Improving the Regulatory Process

The following Table lists issues which have been identified to date in the application of the IDR concept. The accompanying narrative with each issue contains recommended improvements.

Identification and Discussion of Issues Re:
The Use of the IDR Process in Regulatory Reviews

Issue	Discussion
A. There must be assurance that the reviews consider all the important safety issues.	To assure that all important safety issues are considered, the utility Official responsible for the IDR Program and representatives of the cognizant review branch or branches should hold meetings to establish a mutually acceptable agenda for the IDR. It would generally be expected that the General Design Criteria, Regulatory Guides, Standard Review Plans, Branch Technical Positions, IE Bulletins, and recent review experience would constitute the basis for the agenda. If a particular issue or topic is not addressed during the IDR, the NRC will pursue the topic or issue outside the IDR process.
B. There must be assurance that the review is conducted by technically accomplished and knowledgable reviewers who effectively fulfill the role previously performed by the NRC staff.	To assure the quality of the IDR panel and that the panel will effectively complement the role of the NRC staff, the NRC should adopt and communicate to the Applicant the following policy: If NRC observers can conclude that the Applicant IDR is an acceptable substitute for the review that would have been performed by the NRC, in a given area or for a given topic, then the IDR will be credited in the Staff SER as the resolution of that review area or topic. If the NRC observers conclude that the review is insufficient in a particular area or topic, the NRC will pursue the issue outside the IDR process. The NRC will work with the Applicant to assure that a Review Board of exemplary technical competence and independence is convened; with sufficient knowledge of the regulations to assure that the impact of the IDR is maximized.
C. A determination must be made regarding the documentation necessary to meet technical and legal requirements of the licensing process.	To provide an adequate technical and legal basis for licensing the Applicant's design, the NRC will require that the following documentation be provided to the docket: (1) Transcripts of the IDR meetings, (2) Written statements describing how open items have been resolved, and

(3) A statement from the Applicant indicating:

(a) Those NRC regulations, GDCs, SRPs, Regulatory Guides, BIPs, IE Bulletins, etc. with which the design is in full compliance;

(b) Those NRC regulations for which there is not full compliance; and

(c) The justification for non-compliance.

D. The technical and legal role of the NRC must be determined.

The role of the NRC in the IDR process shall be as follows:

(1) The NRC will work with the Applicant to develop the agenda for the IDR meetings.

(2) The NRC will work with the Applicant to enhance the technical quality and independence of the IDR Board of Reviewers. The NRC observers may participate with the Board in questions and comments on the system design.

(3) The NRC will audit the process through observers at IDR meetings, through examination of the transcripts of the meetings, and the resolutions of open items.

(4) The NRC will write its SER based on the following:

(a) The "completeness" and "quality" of the review performed by the Applicant;

(b) The justification provided for non-compliance with established NRC positions; and

(c) Traditional NRC reviews as needed.

E. The role of the public in the new process must be determined.

In accordance with the recommendations of NUREG-0292, the Commission published a Policy Statement in January 1978, regarding the conduct of technical meetings in licensing cases. The policy indicated that to the extent possible technical meetings between the Staff and Applicants should be held in the vicinity of the site and open to the public. The application of this policy to the IDR meetings needs clarification. On one hand, these meetings may be viewed as Applicant meetings in which the Staff is an invited observer participant. In this case, should the Applicant make the decision regarding public participation? On the other hand, if the NRC takes a more active role, as recommended, in the preparation of the meeting, would the policy statement make it mandatory for opening the meetings to the public? In the interim, the staff plans to make these meetings open to the public and would issue meeting notices.

F. The applicability of IDRs to more challenging review areas should be determined.

The applicability of the IDR concept to multi-disciplinary review areas, such as accident analysis, site suitability (geology, hydrology, meterology) and emergency planning must be determined. At this time, it is not clear whether the IDR concept can be successfully applied to these review areas. In addition, any review topic for which acceptance criteria have not previously been developed would be poor candidates for an IDR. Thus, a likely outcome is that SER inputs may be prepared using different techniques [IDR, Q&A, other (i.e., recent MEB experience)]. As a result, the manner in which to schedule and integrate the SER inputs produced must be established. An estimate of a schedule template for the conduct of an IDR, based on our experience to date, is shown in Attachment 1. The question of maintaining the viability of an SER input produced early in the review process must be addressed.

To successfully address the manner in which IDRs can be integrated into the review process it is necessary to determine the number and the extent to which other review areas can apply the IDR concept. An initial survey has identified a number of review areas which may be amenable to IDR's (Attachment 2). A more detailed survey and/or actual experience in each area will be required to determine scope and schedule of these reviews. Then integrated project schedules can be prepared. In addition, consideration should be given to the optimization of the initiation of IDR's. It appears that initiation of IDR's early in the OL phase, or perhaps post-CP stage, may result in maximizing the benefits to the utilities in the conduct of such reviews.

Independent Design Review Template*

Milestone	Δ-Weeks	Total Weeks
IDR Meeting	0	0
Receipt of Transcript	6	6
AE/Vendor Response to Open Items	3	9
Additional Board Questions	8	17
AE/Vendor Response	2	19
Board Closeout	4	23

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Attachment 2
to Enclosure 4

BRANCH: POWER SYSTEMS

IDR MEETING	SRP SECTION	TITLE
1	8.2	Offsite Power Systems
	8.3.1	AC Power Systems (Onsite)
2	8.3.2	DC Power Systems (Onsite)
3	9.5.4 to 9.5.8	D/G Auxiliary Systems and Electrical Controls
4	9.5.2	Communications Systems
	9.5.3	Lighting Systems
	10.2	Turbine Generator (Speed Control and Overspeed Protection System)
	10.4.4	Turbine By-Pass System
5		Fire Review (as scheduled by the Chemical Engineering Branch)

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SYSTEMS WHERE THE IDR PROCESS MAY BE EFFECTIVELY USED

BRANCH: AUXILIARY SYSTEMS

IDR MEETING	SRP SECTION	TITLE
1	3.4.1	Flood Protection
	3.5.1.1	External Missiles (Onside Cont)
	3.5.2	External Missiles
	9.3.3	Floor Drainage
	10.4.5	Circulating Water System
2	9.1.1	New Fuel Storage
	9.1.2	Spent Fuel Storage
	9.1.3	Spent Fuel Cooling
	9.1.4	Fuel Handling
3	9.2.1	Service Water
	9.2.2	Component Cooling Water
	9.2.5	Ultimate Heat Sink
4	5.4.11	Pressurizer Relief Valve
	9.2.3	Demineralized Water System
	9.2.4	Potable and Sanitary Water System
	9.2.6	Condensate Storage
	9.3.1	Compressed Air
	10.3	Main Steam
	10.4.7	Condensate and Feed Water
	10.4.9	Auxiliary Feedwater
5	3.6.1	Protection Against High and Moderate Energy Line Breaks
6	9.4.1	Control Room Ventilation
	9.4.2	Fuel Pool Area Ventilation
	9.4.3	Auxiliary Radwaste Area Ventilation
	9.4.4	Turbine Area Ventilation
	9.4.5	ESF Area Ventilation

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SYSTEMS WHERE THE IDR PROCESS MAY BE EFFECTIVELY USED

BRANCH: INSTRUMENTATION & CONTROL SYSTEMS

IDR MEETING	SRP SECTION	TITLE
1	7.2	Reactor Trip System
2	7.3	Engineered Safety Features
3	7.4	Systems Required for Safe Shutdown
4	7.5	Safety Related Display Instrumentation
5	7.6	All Other Instrumentation Required for Safety
6	7.7	Control Systems Not Required For Safety

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SYSTEMS WHERE THE IDR PROCESS MAY BE EFFECTIVELY USED

BRANCH: REACTOR SYSTEMS

IDR MEETING	SRP SECTION	TITLE
1	4.4	Thermal Hydraulic Design
2	4.6	Functional Design of Reactivity Control
3	5.2.1.1	Reactor Coolant Pressure Boundary
	5.2.2	Overpressure Protection System
	5.2.5	Reactor Coolant Pressure Boundary Leakage Detection
4	5.4.6	Reactor Core Isolation Cooling System (BWR)
	5.4.7	RHR System
5	15.1.1	Primary Coolant System
	15.1.2	Pressure Decrease
	15.1.3	Transients
	15.1.4	
	15.1.5	Steam Line Breaks (PWR)
	15.2.1	Reactor Pressure
	15.2.2	Increase Transients
	15.2.3	
	15.2.4	
	15.2.5	
6	15.2.6	Loss of Non-Emergency AC Power to Station Auxiliaries
	15.2.7	Loss of Normal F.W. Flow
	15.2.8	F.W. System Pipe Breaks (PWR)
	15.3.1	Loss of Flow Transients
	15.3.2	
	15.3.3	
	15.3.4	
	15.4.4	Increase Flow Transients
	15.4.5	

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SYSTEMS WHERE THE IDR PROCESS MAY BE EFFECTIVELY USED

BRANCH: REACTOR SYSTEMS

IDR MEETING	SRP SECTION	TITLE
	15.4.6	Boron Concentration Decrease Increase Reactor Coolant
	15.5.1 15.5.2	Increase Reactor Coolant Inventory Transient
7	15.4.9	Rod Drop Accident (BWR)
	15.6.1	Inadvertent Opening of Safety Relief Valves
	15.6.5	LOCA
8	15.8	ATWS

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Branch Containment Systems Branch

IDR 1 MEETING	SRP SECTION	TITLE
1	6.2.2	Containment Heat Removal Systems
2	6.2.4	Containment Isolation Systems
3	6.2.5	Combustibile Gas Control System (compliance with 10 (CFR 50.44)

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Branch: Core Performance

DR MEETING	SRP SECTION	TITLE
1	4.3	Nuclear Design
2	4.4	Thermal Hydraulic Design

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Branch: Effluent Treatment Systems Branch

IDR MEETING	SRP SECTION	TITLE
1	Chap. 11	Radioactive Waste Management

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Branch: Radiation Assessment Branch

IDR MEETING	SRP SECTION	TITLE
1	Chap. 12	Radiation Protection