Staff Report To
The President's Commission On

THE ACCIDENT AT THREE MILE ISLAND

The Nuclear Regulatory Commission

THE PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

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ON

THE NUCLEAR REGULATORY COMMISSION

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I. INTRODUCTION

Section 3(d) of the President's charge to this Commission requires "an evaluation of the Nuclear Regulatory Commission's licensing, inspection, operation, and enforcement procedures as applied to" the Three Mile Island nuclear facility.

This report considers the statutory authority of the Nuclear Regulatory Commission (NRC), puts the agency into historical context, and examines the agency's important structures and practices, as illuminated by the Three Mile Island accident.

The Atomic Energy Act of 1946 created the Atomic Energy Commission (AEC). The Atomic Energy Act of 1954 provided for "...A program to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes to the maximum extent consistent with the common defense and security and with the health and safety of the public...."1/

By 1974, public skepticism regarding the AEC's ability to regulate in the public's interest set the stage for the AEC's dissolution.2/

During the Senate debate on the Energy Reorganization Act of 1974 (the Reorganization Act), Senator Abraham Ribicoff explained that the bill was necessary because, "[a]s a result of the heavy federal emphasis on commercial nuclear power, the development of the nuclear power industry has been managed by the same agency responsible for regulating it.... It is difficult to determine in the organization scheme of the AEC where the [AEC] ends and the industry begins 3/

Congress' solution was a major reorganization of nuclear power regulation. The Reorganization Act abolished the AEC. It created the Energy Research and Development Administration (ERDA), now part of the Department of Energy (DOE), and a separate Nuclear Regulatory Commission.

ERDA added the AEC's development activities to its similar responsibilities for other technologies. The NRC assumed the AEC's regulatory responsibilities4/ -- its basic mission being "to regulate civilian

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1/ Atomic Energy Act of 1954, as amended, Public Law 83-703, Ch. 1, Sec. 3(d).

2/ E. Rolph, Nuclear Power and the Public Safety, at 155 (1979), hereinafter cited as "Rolph."

3/ Mazuzan, George and Trask, Roger, An Outline History of Nuclear Regulation and Licensing 1946-1979, April 1979, at 86, hereinafter cited as "Mazuzan and Trask."

4/ Rolph, supra, at 155.

nuclear activities so that the public health and safety, national security, and environmental quality are protected 5/

Now, less than 5 years after the creation of the NRC, the Three Mile Island accident has raised the question of whether the major reorganization of 1974 was adequate to ensure that the public health and safety, rather than the well-being of the nuclear industry, would be the primary concern of NRC regulatory activity.

One commentator has recently concluded that:

> The reorganization [of 19741 has not caused any major transformations under regulation. Although the NRC is out from under the shadow of the AEC's development wing, it is mostly staffed by those who staffed the AEC during its last years. It has inherited the same regulatory traditions, it faces the same technical problems and uncertainties that plagued its predecessor, and its basic approach to safety ... has not changed.6/

That general observation is confirmed by the testimony heard in this investigation. For example, Jesse Ebersole, a member of the Advisory Committee on Reactor Safeguards (ACRS), stated:

> [I]t is a rather striking development of this particular case [the TMI accident], they [safety concerns] don't seem to be able to penetrate what I will loosely call the shell of middle management. They stay subdued 7/

NRC Commissioner John Ahearne stated:

> I still think it [the NRC] is fundamentally geared to trying to nurture a growing industry.8/

Finally, according to NRC Commissioner Victor Gilinsky, "[t]here has, I think, been too little commission involvement in the setting of safety policy in this agency and too little commission guidance to safety matters to the staff and to the board."9/

5/ 1978 NRC Annual Report at 1.

6/ Rolph, supra, **at** 155.

7/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 152.

8/ Ahearne deposition at 230.

9/ U.S. House of Representatives, Subcommittee on Energy, Natural Resources, and the Environment, Oversight Hearings on Nuclear Regulation, June 4, 1979, at 74-75; TMI Commission hearings, Gilinsky testimony, June 1, 1979, at 143-144.

The present investigation has confirmed that numerous regulatory deficiencies of the AEC continued with the NRC, and that they contributed substantially to the accident at the Three Mile Island reactor.

An example is provided by NRC's failure, during the 5 years of its existence, to develop any effective mechanism for learning from the ongoing operational experience of licensed reactors. The AEC was criticized for being "quite uninterested in developing a strong information-gathering capability of its own either to anticipate problems or to independently verify information responses from industry."10/

In 1969, an AEC internal study group recommended a systematic examination of reactor operating and test data, the lessons learned to be fed back into new designs and criteria. 11/ In 1976, the NRC evaluated three methods of obtaining and evaluating the operating experience of licensed reactors. 12/ None was adopted. 13/ In January 1979, after an investigation, the General Accounting Office (GAO) complained that the NRC's failure to assess licensee event reports (LERs) prevented the agency from identifying safety-related problems.14/

Yet, at the time of the Three Mile Island accident, the NRC still had no formalized mechanism to achieve that kind of review of operating experience at licensed reactors. 15/ Thus, operating information which might have prevented the accident, had it been adequately assessed and disseminated by the NRC, instead "fell between the cracks."

Similar deficiencies exist in numerous other areas of NRC's regulatory effort. Many contributed to the Three Mile Island accident. Included among those examined in this report are the NRC's reliance on the industry to regulate itself despite the industry's financial disincentives to do so; a concomitant and repeatedly demonstrated inability of the NRC to resolve safety concerns raised by individuals within the agency; a disassociation of the resolution of generic safety problems from the agency's ongoing plant licensing activities; NRC's two-step licensing process, which provides for a detailed design safety review only after construction of the plant is nearly complete; and the agency's resistance to retroactive application of its current safety requirements, on account of the "burden" this would impose on the industry.

10/ Rolph, supra, at 97.

11/ Report to the Atomic Energy Commission on the Reactor Licensin Program (June 1969) at 29-30.

12/ 1978 NRC Annual Report at 3-4.

13/ Id.; Budnitz deposition (Aug. 27, 1979) at 62.

14/ GAO Report, "Reporting Unscheduled Events at Commercial Nuclea Facilities: Opportunities to Improve Nuclear Regulatory Commission Oversight," EMD-79-16 (Jan. 26, 1979) at i.

15/ Seyfrit deposition at 73.

Given time and personnel limitations, many issues could not be addressed and others could not be addressed in the breadth and depth they require. Therefore, this report should not be viewed as a definitive or exhaustive treatment of the NRC.16/ However, even this limited treatment reveals substantial deficiencies in this agency, and presents the question of whether the 1974 Reorganization Act has accomplished its purpose. When asked whether a second such reorganization would provide the answer, ACRS member Ebersole replied:

> I think some improvements could be brought about by changing the structure. On the other hand, I think simply calling people by different names and hanging new titles on the doors everywhere does nothing.17/

More acutely, the question of whether NRC has learned the important lessons of TMI-2, and whether those lessons are "necessary and sufficient for the continued safe operation of operating plants and for the resumption of staff licensing activities" 18/ is raised throughout this report, including in the post-accident context.

16/ The legal staff of this Commission that investigated the NRC was composed of three attorneys, four legal assistants, and a law clerk. Staffing, however, was not completed until mid-July 1979. During the course of the investigation, a total of 60 NRC-related depositions were taken and at least 100,000 pages of NRC-related documents were received. Also, predeposition interviews were held with various people who were deposed, in addition to numerous additional interviews.

Although the investigation was intended to be as broad in scope as possible, time and personnel limitations prevented any inquiry into the following NRC offices: Atomic Safety and Licensing Board and Appeal Board, Office of Management and Program Analysis, Office of State Programs, Office of Inspector and Auditor, and Office of Policy Evaluation. The investigation was limited to the major NRC offices involved in both the licensing and enforcement areas.

17/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 152.

18/ Memorandum from Harold Denton to NRC commissioners, Aug. 20, 1979.

II. HISTORICAL CONTEXT OF THE ENERGY REORGANIZATION ACT OF 1974

> The rapidity of technological evolution is, in many instances, outstripping our ability to assess the risks of application. The public has a vastly heightened appreciation of "risks," both everyday and novel, and seems generally more inclined to expect government to intervene as its protector. And Congress, responding to these changes, has significantly expanded federal regulatory authority.19/

The Atomic Energy Act of 1946 was intended primarily to tighten government control over nuclear weapons and to safeguard the American atomic weapons monopoly.20/ The act created a five-man civilian Atomic Energy Commission, appointed by the President with the consent of the Senate. The commission was given a virtual monopoly over nuclear technology, and all nuclear-related programs were transferred to it from the military.21/ With one exception, concern for the public health and safety was absent from the 1946 Act. The exception arose from the fear that fissionable material could be diverted. The act required that all fissionable material and its transfer be licensed, and directed the AEC to control the distribution of fissionable material as required "to protect the public health and safety." 22/ However, between 1947, when the act took effect, and 1954, when it was superseded, the AFC formally adopted only two minor safety regulations in this area.23/

In the early 1950s, a number of manufacturers and utilities began to explore the potential for nuclear electric power generation. Industry calculated that the cost per kilowatt-hour would equal the average cost for conventional power production. 24/ In response to industrial interest, the AEC focused its developmental activity on commercial reactors. 25/ In 1952, the AEC chairman urged Congress to make development of nuclear electricity generating capability a top government

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19/ Rolph, supra, at 1.

20/ Mazuzan, and Trask, supra at 1; The Atomic Energy Act of 1946, Sec. 1(b)4, 60 Stat. 755; Rolph, supra, at 21.

21/ Rolph, supra, at 21.

22/ Id. at 22.

23/ Joint Committee on Atomic Energy, Improving the AEC Regulatory Process, Volume II, March 1961, at 438, cited in Rolph, supra, at 22, 29.

24/ Rolph, supra, at 26.

25/ Id. at 26-27.

priority.26/ Later that year, President Eisenhower presented his "Atoms for Peace" speech before the General Assembly of the United Nations:

> The United States would seek more than the mere reduction or elimination of atomic materials for military purposes. It is not enough to take this weapon out of the hands of the soldiers. It must be put into the hands of those who will know how to strip its military casing, and adapt it to the arts of peace.27/

In his budget message the following year, Eisenhower recommended that the Atomic Energy Act of 1946 be amended to, among other things, encourage industry to develop nuclear power.28/

In the spring of 1954, hearings began on new atomic energy legislation. The AEC, the President, Congress's Joint Committee on Atomic Energy, and the industrial community joined together in supporting legislation to facilitate the commercial development and exploitation of nuclear power by private industry.29/ The hearings focused on making the nuclear industry economically independent and competitive. Although safety is mentioned in the act, there was no discussion of possible safety hazards during the hearings and no discussion of what might constitute "acceptable" levels of risk.30/

The new act, signed into law later that year, broadly provided for "...a program to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes to the maximum extent consistent with the common defense and security and with the health and safety of the public .... " 31/

The legislation sought to accomplish this by providing for: private ownership of nuclear facilities; private use of fissionable material; and industrial access to the government's technical information. 32/

26/ Id.

27/ Eisenhower, Dwight D., "An Atomic Stockpile for Peace," Vital Speeches of the Day, published Jan. 1, 1954, at 164.

28/ Rolph, supra, at 27.

29/ Id. at 27; see also S. Rep. No. 1669, 83rd Cong. 2nd Sess., reproduced in 1954 U.S. Code Cong. & Admn. News, at 3464.

30/ Rolph, supra, at 27-28; see also Mazuzan and Trask, supra, at 37.

31/ The Atomic Energy Act of 1954 as amended, Public Law 83-703 Ch. 1, sec. 3(d).

32/ Rolph, supra, at 27; Mazuzan and Trask, supra, at 34; A brief legislative history of the 1946 and 1954 Acts may be found in Northern States Power Co. v. Minnesota, 447 F. 2d 1143, 1147-48 (8th Cir. 1971) aff'd 405 U.S. 1035 (1972).

The legislation also established a two-phase licensing program, consisting of a construction permit and then, "upon finding that the facility has been constructed" in conformity with the act, the utility's approved application, and the rules and regulations of the AEC, a license to operate.33/ As part of its regulatory function, the AEC was authorized to promulgate regulations, standards, and orders to prevent diversion or loss of nuclear material to "protect health and minimize danger to life and property."34/ The act also afforded a hearing, upon request, to any person whose interests may be affected by a proposed nuclear facility, and subjected any final order to judicial review.35/

However, the AEC licensing procedures were seriously questioned:

> Analysis of the construction permit procedure pointed out a number of disturbing facts. The commission did not publish a document setting the safety problems, if any, raised by an application. Nor did it make available the ACRS reports. [It was possible to do this by use of the Public Document Room].... Additionally, the public notice was given on the basis of *fait accompli.* A potential intervenor could not do so until after the licensing action had been taken. Finally neither the 1954 Act nor the AEC regulations indicated how far a company might go in the construction of a reactor without obtaining a construction permit. Theoretically, construction could proceed quite far before the regulators might officially take notice of the matter. This procedure soon invited criticism. 36/

In June 1955, the AEC established a Division of Civilian Application to function as both a promotional and regulatory office. This division had the general responsibility for encouraging private enterprise in the civilian use of atomic energy. 37/

Congress first seriously questioned the AEC's combined promotional and regulatory responsibilities in 1956 when the AEC granted a construction permit to the Power Reactor development Company, headed by Detroit Edison, to build the Fermi fast breeder reactor 20 miles from Detroit. The AEC issued the permit despite ACRS, staff, and congressional analyses raising safety questions. In reaction, the Congressional Joint Committee

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33/ Atomic Energy Act of 1954, Ch. 16, Sec. 185, 68 Stat. 919 (current version at 42 U.S.C. 2011-2296 (1970)); Rolph, supra, at 28.

34/ Atomic Energy Act of 1954, P.L. 83-703 (68 Stat. 919), 1954, Ch. 1, as cited in Rolph, supra, at 28.

35/ P.L. 83-703, C.16, Sec. 189(a)(b)(1954); see also Rolph, supra, at 29.

36/ Mazuzan and Trask, supra, at 42-43.

37/ Id. at 39-41.

on Atomic Energy (JCAE) conducted a study of AEC's licensing procedures in three areas: whether a public hearing should be held before making a decision on a permit; whether reports on reactor safety should be made public; and whether there should be a separation of the regulatory from the promotional and developmental functions of the commission.38/

The JCAE study, as well as one prepared by the AEC, recognized a need for separation of the promotional and regulatory functions of the agency, but argued against dividing the agency itself because it would "hinder the overall promotional objectives of the AEC, would cause a duplication of personnel, and would increase red tape."39/

The AEC also opposed a proposal to increase the formality of its decision-making process and open it to public view via a mandatory hearing on each license application. The AEC argued that such a procedure would delay action on licensing applications while offering no real extra benefits. 40/

As noted several years later in Science magazine,

> Much of the strong feeling about the [Fermi] case stemmed from a conviction that the public was being put in danger in order to make it possible for private power interests to take over atomic power, a situation which, if true, would strike supporters of public power as especially outrageous after the possibilities of atomic energy had been developed only through vast public expense. 41/

In order to avoid further charges that its dual role as developer and regulator jeopardized its ability to decide the Fermi question fairly, the AEC created a "separate" group -- actually composed of AEC staff -- to examine the case. The procedure was later formalized,

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38/ Id. at 45-46; the 1946 Act created a General Advisory Committee to the AEC. Upon recommendation of the committee, the AEC formed a Reactor Safeguards Committee in 1947 and an Industrial Committee on Reactor Location Problems in 1950. In 1953, the committees were merged into the Advisory Committee on Reactor Safeguards (ACRS). See, Rolph, supra, at 23; Lawroski and Moeller, "The Advisory Committee on Reactor Safeguards-Its Role in Nuclear Safety" (Sept. 26, 1978).

39/ Mazuzan and Trask, supra, at 46-47; see also Rolph, supra, at 41.

40/ Rolph, supra, at 42.

41/ Science, Vol. 133 (January-June 1961), at 1908, quoted in Rolph, supra, at 39-40.

so that all applications were reviewed by a staff which was prohibited from contact with the AEC and the rest of the agency.42/

The AEC ultimately won its battle to issue a construction permit for the Fermi breeder reactor. But:

> ...it lost much in the way of credibility and freedom of action. The Fermi case demonstrated that the AEC's subjective, personalized style of decision-making could not stand up to an outside challenge. The review process could not accommodate adversary proceedings in a way that appeared sufficiently fair or objective. And the Commission's behavior in the case cast doubt upon its ability to be an impartial judge while it shouldered developmental and promotional obligations.
>
> The well publicized disagreement between the ACRS and the commission also called public attention to the fact that there continued to be substantial gaps in our information about the hazards imposed by nuclear technology and that... experts could still differ.43/

By 1957 legislative amendments, the AEC was required to change some of its licensing procedures. The 1957 statute established the ACRS as a statutory body to review all applications for construction and operation of nuclear facilities, and required issuance of public report. The 1957 legislation also required the AEC to hold public hearings on all applications.44/

With the establishment of the Office of the Hearing Examiner in 1958, the AEC commissioners began relying on the hearing examiner's decisions on construction permits and operating license applications. While this procedure somewhat increased public access to the process, it also isolated the commissioners from the decision-making process in licensing matters: "...[A]s they concerned themselves more and more with promotional activities, it was easy to leave these licensing decisions to the examiner."45/

The hearing examiner was replaced in 1962 by licensing boards composed of three members, one law-trained and two technically trained.

42/ Rolph, supra, at 4043. The AEC informed the JCAE by letter, Dec. 12, 1956, of the separated staff for the Fermi application. "A Study of AEC Procedures and Organization in the Licensing of Reactor Facilities," (Joint Committee on Atomic Energy) April 1957, at 38. The ex parte rules governing contact between commissioners and staff are discussed in detail in Section III.B. of this report, infra.

43/ Rolph, supra, at 42. The construction permit was upheld in Power Reactor Development Co. v. International Union, 367 U.S. 396 (196 1)

44/ Mazuzan and Trask, supra, at 47.

45/ Id. at 49.

The Atomic Safety and Licensing Boards (ASLB) were created to ensure a fairer hearing on technical matters, and to create a "greater public appearance of legitimacy," which freed more time for the commissioners for promotional functions.46/

In 1969 the commissioners were further insulated from the licensing process when they created the Atomic Safety and Licensing Appeal Boards (ASLAB). Other than the addition of the appeal boards, the organization of the licensing process within AEC did not undergo further significant changes.47/

Public concern over the AEC's policies and organization increased during the environmental movement in the 1960s. Specifically, concern increased over the AEC's duel function as promoter and regulatory as public disagreements arose within the scientific community regarding reactor safety.48/

Two examples involve: Pacific Gas and Electric's application in 1962 to construct a boiling water reactor at Bodega Head, on the California coast north of San Francisco and very near the San Andreas Fault; and the Los Angeles Department of Water and Power's 1963 application to build the Malibu reactor in an active southern coastal seismic area. In both cases, the utilities encountered surprisingly intense opposition from local citizens' groups and intervenors, and withdrew their applications, despite AEC readiness to grant construction permits.49/

During the same period, the number of construction permit applications increased dramatically. Between 1962 and 1966, the AEC received applications for 26 units, 15 of them in 1966 alone. Over the same 4 years, average reactor capacity doubled and plants increased markedly in technical complexity and in design variations. The larger designs had different fuel burn-up characteristics, greater power densities, and higher temperatures.50/ As a result, and despite an increase in the numbers of reviewers, review time (application to construction permit issuance) increased to nearly 9-1/2 months, and was expected to increase substantially

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46/ Id., at 49-50. The AEC was authorized to create these boards by legislation passed in 1962. Public Law 87-615 (76 Stat. 409) (1962), Section 1

47/ Jensch, "Hearing and Decisional Procedures of the Nuclear Regulatory Commission" (unpublished paper prepared for the President's Commission) at 2-3, 18-19.

48/ Mazuzan and Trask, supra, at 66-67.

49/ Rolph, Supra, at 63-64.

50/ Id. at 79-81; "One obvious difference is for very small plants is there is no chance of the core melting down and going through the bottom of the reactor vessel because it doesn't have that much energy contained in it." (Denton deposition at 150).

when new reactor orders (8 in 1965, 21 in 1966, 27 in 1967) became license applications.51/

In 1965, the AEC appointed a panel, headed by former AEC counsel William Mitchell, to study the licensing procedure and recommend change to speed up the licensing of reactors. The Mitchell panel recommended that the AEC increase development of criteria and standards, but limit these to specific safety concerns rather than general design criteria; precisely define what information had to be supplied by the licensee on applications; coordinate the safety research program with the regulatory requirements; narrow the ASLB's responsibility in the application review process to determining whether the staff analysis provided adequate support for the staff conclusion; and eliminate the mandatory review of the applications by the ACRS. A number of these recommendations were implemented by the AEC by rule-making.52/

A second Mitchell panel was appointed by the AEC in April 1966 to study contested construction and operating applications. The panel generally approved AEC practices for dealing with contested permit and license applications. Its recommendations included a strict schedule for public intervenors, a prehearing conference, and other procedures designed to shorten the process. It also recommended that guidelines be furnished to the ASLB's regarding recurrent technical issues and to encourage their reliance on decisions in previous cases. These recommendations were substantially adopted by the AEC through rule-making.53/

Thus, while public intervenors became increasingly vocal with claims of environmental and technical dangers posed by the burgeoning nuclear industry, the AEC and its supporters focused on methods to expedite the licensing process. Chauncy Starr, then president of Atomics International, summed up industry's position:

51/ Rolph, supra, at 71; Mazuzan and Trask, supra, at 58-59.

52/ Rolph, supra, at 71-73; Mazuzan and Trask, supra, at 59; Jensch, supra, at 6-7. The recommendation regarding the ASLB, which was implemented, later came under exacting criticism. The ASLB does not normally undertake a de novo review of all the issues resolved between the staff and the applicant. Instead the ASLB hearing usually tests the adequacy of the staff's findings. Thus, the substance of the staff review became largely hidden from view. "Moreover, it is this role of the staff in justifying its conclusion which has high public visibility. Rather than hearing the staff candidly discuss the risks, the public hears only comments designed to allay public concern and reflecting the view that the risks are acceptable." (H. Green, "Public Participation in Nuclear Power Plant Licensing: The Great Delusion" 15 William and Mary L. Rev. 503, 509 (1974).)

53/ Mitchell panel report to the AEC, June 15, 1967.

> Safety is a relative matter and I believe we have reached a point in the demonstrated safety of nuclear power to say nuclear power is safe, period. 54/

For its part, the AEC let technological change and commercial use move with the dictates of the market. To compensate for existing uncertainties, the regulatory staff adopted the most conservative design requirements "consistent with the commercial viability of the nuclear power reactor."55/ The staff had no intention of seriously constraining its commercial use.56/ Throughout the 1960s, the AEC's general decision-making principal was to be:

> ...as conservative as possible short of disrupting this commercialization process. As the uncertainties grew, the commission chose to live with them.57/

The AEC attitude regarding accidents for many years was to contain them rather than prevent them. 58/ This strategy began to change only after issuance of the Ergen Report in 1967, which suggested that containment might not be completely successful in a large-scale accident.59/

When Congress passed the National Environmental Policy Act (NEPA), effective January 1, 1970,60/ all federal agencies were required to consider the environmental impact of the licensing of any new facility. The AEC, which had opposed the bill, was slow to implement fully the details of the act. This response was later castigated in the Calvert Cliffs decision, in which Judge J. Skelly Wright wrote:

54/ Quoted in Rolph, supra at 76. Starr complained of a regulatory licensing bottleneck that he believed was bureaucratic in design. Id. However, different views have been expresssed as well on this point: "[T]he available evidence illustrates fairly convincingly that bureaucratic and intervenor-induced delays account for very little of the total delay experienced. Government studies conducted regularly since 1971 have uniformly concluded that as few as 15 percent of the delays in the nuclear licensing process are attributable to regulatory and licensing problems." Environmental Law Reporter, "Facilitating the Nuclear **Alternative**," 8 ELR 10087, 10091 (1978). See also Rolph, supra, at 123-125.

55/ Rolph, supra, at 77.

56/ Id. at 76-77.

57/ Id. at 97.

58/ Mazuzan and Trask, supra, at 44, 55.

59/ Id. at 61.

60/ Public Law 91-190 (83 Stat. 852)

"We believe that the Commission's crabbed interpretation of NEPA makes a mockery of the Act." 61/ Two days before this decision was handed down, James Schlesinger became Chairman of the AEC. One of his first actions was to announce that the commission would respect the decision and would not appeal.62/

In early 1971, the AEC responded to growing intervenor attacks with a proposed amendment to the Atomic Energy Act, which would have limited public intervention to an early mandatory hearing to be held at the point of site authorization: would have permitted intervention at the construction permit stage only if an unresolved public health or safety issue could be raised; and would have prohibited intervention at the operating license stage, where the delays were most costly and the intervenors exercised the most leverage.63/

Even the promotion-oriented Congressional JCAE "could not support the AEC in such a blatant effort to bar the public from the licensing process" and the proposed amendment was dropped in subcommittee.64/

One commentator has summed up the AEC regulatory posture during the 1960s and early 1970s as follows:

> Quite possibly the commission's eagerness to see the reactor succeed caused it to be more responsive to industry and shut its eyes to other pressures
>
> [However] the regulatory body needs to acknowledge its political role, remaining sensitive and responsive to the public will. If it does not, in a democratic system, its opponents can and will find alternative access to the decision process. If the regulatory authority is sufficiently out of touch, it might be reconstituted or power might be transferred 65/

As previously noted, Congress separated the AEC's promotional and regulatory roles in 1974 with the adoption of the Reorganization Act66/ that created the NRC for the primary purpose of protecting the public health and safety, national security, and the environment,67/ and ERDA to conduct research and to promote development of all forms of energy.

61/ Calvert Cliffs' Coordinating Committee v. AEC, 449 F. 2d 1109, 1117 (D.C. Cir. 1977).

62/ Rolph, supra, at 132.

63/ Id. at 116.

64/ Id.

65/ Id.

66/ Public Law 93-438, 42 USC 5801 (1974).

67/ NRC 1978 Annual Report at 1.

However,

> The regulatory bureaucracy of the AEC, which has grown to about 2,000 people when the NRC started to function, was transferred almost intact to the new [NRC). Thus, the NRC was established with essentially all its leadership and the bulk of its professional staff fully conditioned to overlooking or neglecting difficult questions.68/

Problems with the regulatory process remained, despite the 1974 reorganization. For example, a December 1976 JCAE staff study found that:

> It is not clear either from the legislative charter of NRC or from its organizational chart which office is actually responsible for the day-to-day management of the Nuclear Regulatory Commission. The Chairman of the commission would not appear to have the time to administer the commission on a daily basis. Even if he did, he is much too removed and isolated from the day-to-day problems by the layer upon layer of management in the organizational structure.69/

Allegations that the NRC management was not responsive to safety concerns raised by its technical staff were also addressed by the JCAE staff:

> The Nuclear Regulatory Commission should adopt and publish, as Commission policy, the procedures by which professional employees can raise unresolved technical concerns within their field of competence and responsibility and do so without any fear of reprisals in any form whatsoever. If such a Commission policy is not adopted on an NRC-wide basis, the Atomic Energy Act of 1954, as amended, should be amended for that purpose.70/

This recommendation was made in response to charges that the NRC had "covered up and brushed aside nuclear safety problems of far-reaching significance."71/

68/ Brightsen, "The Way to Save Nuclear Power" (*Fortune*, Sept. 10, 1979), at 128. See also D. Diggins, "Legislative History of the Energy Reorganization Act, 1974," Vol. 1 at 982-983. The new agency was originally to be called the "Nuclear Safety and Licensing Commission," and was expected to ensure the "safe development" of the nuclear industry. Id.

69/ Staff Report to the Chairman of the JCAE on the Allegations Concerning Nuclear Safety, Dec. 3, 1976, at 8.

70/ Id. at 10.

71/ Id. at 1. The NRC response to this report, sent to the chairman of the House Subcommittee on Energy and the Environment, disagreed with the subcommittee conclusions on the ground that steps had already been taken by the NRC to remedy its internal problems before the JCAE Staff Report was issued.

The JCAE staff also found that the Executive Director's Office of the NRC could not perform "as an effective manager of the Commission's offices because the major offices can by-pass him and go directly to the Commission. No one is in a position to manage effectively the Commission's organization and no one is so doing." 72/ On June 24, 1979, NRC Commissioner Ahearne observed that nothing had changed.73/

The NRC also inherited AEC's regulatory difficulties posed by this growth of larger, unstandardized commercial reactors. Despite AEC's establishment of a maximum plant size in 1973 in order to gain "sufficient experience... with design, construction, and operation of plants," the problems continued.74/ After the TMI-2 accident, Robert Minogue, director of NRC's Office of Standards Development, stated that currently operating reactors grew too large too fast, are now a "generation of prototypes," and are:... different from the earlier nuclear plants on which much of the [nuclear] experience and technology was based.. [T]hey are in effect new machines... [T]hey are facilities for which you have no real prior base of applicable operating experience.... And the feedback -- the information that flows back from these prototypes is really the only clear source of information you have on the operating characteristics of facilities of the size .... what we have today in the nuclear industry is a number of facilities which in a sense each one proposed has to be evaluated and taken de novo as a new thing and evaluated in the context of feedback information that's flowing in from those [as]...they are being reviewed.75/

72/ Id. at 8.

73/ Speech before The National Energy Resources Organization, June 24, 1979, at 14.

74/ Regulatory Guide 1.49 limited plant size to 3,800 megawatts thermal. See also Minogue disposition, exhibit 2 at 2.

75/ Minogue deposition at 19-21, as corrected by Minogue's errata sheet; see also, Gilinsky deposition at 25 (NRC staff "being in a position of trying to catch up with what was deployed out in the commercial world").

In response to a request from Commissioner Pigford, General Electric and Westinghouse provided comments on a number of issues addressed in this Commission's staff reports, including the issue raised by Minogue's testimony. GE claims inter alia that large reactors are not prototypes, but are based on "extensive and comprehensive testing and operating information" and "represent a modest evolutionary change, in size and technical features..." (Letter from A. Phillip Bray, General Electric Co., to TMI Chairman Kemeny, Oct. 19, 1979, at 1-2). Westinghouse maintains that "appropriate scale-up to larger power reactors" has been achieved "through a stable and mature product, which has the flexibility to be varied in modular fashion to obtain a variety of power ratings" and "by rigorous NRC/AEC application reviews including system response to abnormal operating conditions." (Letter from W. Jacobs, Westinghouse Electric Corp. to Chairman Kemeny, received, Oct. 22, 1979, at 3).

Industry's decision to design larger and larger plants was based on economics:

> The industry's decision to proceed to larger and larger sizes in these plants [was] based largely on the [industry's] perceived economies of scale or economics of scale with only limited recognition of the engineering problems involved with major scale-ups or extrapolation of the components and complex systems.76/

For the NRC, "...[M]uch of the ratcheting of regulatory requirements for the operating plants about which industry has complained has been a direct result of the fact that the unduly rapid push to larger sizes has resulted in what amounts to a generation of prototypes."77/

According to a member of the NRC's Advisory Committee on Reactor Safeguards:

> ... it is far more difficult to fix safety-related designs after the fact. And inevitably, you will iterate so many times that you can't afford to any longer, and then you adopt some other procedure, such as the safety guides, the general criteria. In a disconnected and loose way, you influence the design activities, but not to the extent that you actually participate in the development of detail.78/

76/ Minogue deposition at 15; see also Minogue deposition exhibit 2 at 2. The nuclear industry, however, claims that it had not realized any benefits due to economies of scale:

> With an increase in plant size, it should be expected that the engineering per kilowatt (kw) and the material per kw would drop. Actually there has been an increase which can be attributed primarily to escalations in the [NRC's] regulatory requirements applied to the design. Significant engineering and construction rework has resulted from these escalations during the engineering and construction phase.

(Atomic Industrial Forum, Inc., "Licensing, Design and Construction Problems: Priorities for Solution," January 1978, at i, 14.)

77/ Minogue deposition, Exhibit 2 at 3; see also, Minogue deposition 21. See also, Denton deposition at 154-155. "[W]e have to turn from relying on paper analyses of how plants will perform, which was all we had back in the 1960s, to a much more reliance on the actual operating experience".

78/ TMI Commission hearing, Ebersole testimony, Aug. 22, 1979, at 146.

During the final session of the 95th Congress, three new enactments expanded NRC responsibilities: the Nuclear Nonproliferation Act of 1978 79/; the NRC Authorization Act for Fiscal Year 1979 80/; and the Uranium Mill Tailings Act of 1978.81/

The Nuclear Nonproliferation Act (NNPA) charged the NRC with: ensuring that nuclear export activities are conducted promptly and are consistent with national security and the specific NNPA criteria; strengthening International Atomic Energy Agency safeguards; improving physical protection measures; improving nuclear fuel assurances to other countries; renegotiating bilateral agreements for cooperation; evaluating alternative nuclear fuel cycles; and developing a spent fuel disposition policy.82/

The 1979 Authorization Act required the NRC to conduct, in conjunction with other federal agencies, design and planning studies for research on the health effects of low level radiation; report to Congress on the status of domestic safeguards; monitor, assist in, and report on fuel cycle systems studies under way by DOE and the International Nuclear Fuel Cycle Evaluation; not discharge or discriminate against employees who assist in the NRC enforcement process; investigate and report on present and future radioactive waste storage and disposal; report to Congress on contractor, consultant, and national laboratory use by the agency; review and revise the membership and process of ASLBs; and establish regulations against conflicts of interest for persons under contract to the NRC.83/ The Uranium Mill Tailings Act of 1978 extended NRC's licensing and regulatory authority to include uranium mill tailings.84/

79/ Public Law 95-242, 22 USC 3201.

80/ Public Law 95-601.

81/ Public Law 95-604, 42 USC 7901.

82/ 1978 NRC Annual Report at 149-150.

83/ Id. at 11-12.

84/ 42 USC 7901; see also, 1978 NRC Annual Report at 12-13. Uranium mill tailings are the waste materials produced when mined uranium ore is physically and chemically treated in uranium mills. 1978 NRC Annual Report at 68.

III. POST-1974 STRUCTURE OF THE NUCLEAR REGULATORY COMMISSION AND THE ROLE OF THE COMMISSIONERS

INTRODUCTION

For present purpose, only a general overview of the NRC is provided. The responsibilities, functions, and deficiencies of a number of NRC's offices, divisions, branches, and committees are explored in greater detail in the sections of this report dealing with licensing, inspection and enforcement, operator training, and NRC's Three Mile Island accident-related activities.

The NRC organization consists of:

- the five-member commission, the commission staff, the Advisory Committee on Reactor Safeguards, the Atomic Safety and Licensing Board and the Atomic Safety and Licensing Appeal Board;

- the executive director for operations;

- five program offices; Office of Nuclear Reactor Regulation, Office of Nuclear Material Safety and Safeguards, Office of Nuclear Regulatory Research, Office of Standards Development, and Office of Inspection and Enforcement; and

- several staff offices, including the Office of International Programs and the Office of State Programs.

NRC activities are conducted at a number of headquarters offices located in Silver Spring, and Bethesda, Md., in Washington, D.C., and in five regional offices, which are managed and directed by the Office of Inspection and Enforcement. 85/ Of 2,723 NRC employees, approximately 2,400 are located at the headquarters offices; the five regional offices employ the balance of approximately 320.86/

Approximately 70 percent of the NRC's employees are in the major program offices, about 21 percent in program direction and coordination, and some 9 percent are employed at the commission staff levels, including the advisory and adjudicatory bodies.87/

More than half of NRC's employees are trained as scientists or engineers. Approximately 70 percent hold college degrees.88/

85/ 1978 NRC Annual Report at 261-262.

86/ Id. at 253.

87/ Id. at 247.

88/ Id.

The Office of Nuclear Reactor Regulation (NRR) issues construction permits and operating licenses for commercial, test, and research reactors. It reviews license applications to ensure that facilities are built and operated "without undue risk to the health and safety of the public and with minimal impact on the environment." 89/ NRR also reviews the financial capability of construction permit applicants to ascertain whether the applicant is properly indemnified against accidents and is not in violation of the antitrust laws.90/

89/ Id. at 262. See also, Sec. 203(b) of the 1974 Energy Reorganization Act, 42 USC 5843(b).

90/ Id.; see also Section 203(b) of the 1974 Energy Reorganization Act, 42 USC 5843(b). The Price-Anderson Act (P.L. 85256, 42 USC 2210) was passed in 1957 to limit the maximum liability of utilities for nuclear accidents ($560 million) and in return, provide faster and more assured payment to those injured.

A 1966 amendment to the Price-Anderson Act establishes a "waiver" system on the part of utilities. The NRC requires that licensees waive specific state law defenses, creating, in effect, strict liability. The amendment also provides for a consolidated proceeding in a single federal district court for all claims arising out of a nuclear accident.

The waiver provisions of the 1966 amendment were effective only if the NRC determined that an "extraordinary nuclear occurrence" (ENO) had taken place. (42 USC Sec. 2014j). An ENO is defined to be:

> Any event causing a discharge or dispersal of source, special nuclear or byproduct material from its intended place of confinement in amounts offsite or causing radiation levels offsite, which the Commission determines has resulted or probably will result in substantial damages to persons offsite or property offsite. (Atomic Energy Act, subsection llj, 42 USC Sec. 2014j.)

Once the NRC determines that an ENO has occurred, a claimant need not prove negligence by the utility, but must prove damages and causation. (44 Federal Register 43129-30.) The finding by the NRC regarding an ENO is not subject to judicial review (44 Federal Register 43130). As required by the act, the NRC has established criteria for determining those nuclear accidents which qualify as an ENO. (10 CFR Subsec. 140.84-85). Two conditions must be satisfied for a finding of an ENO: (1) persons or property have been exposed to radiation of specified amounts as a result of the release of material from a reactor, and (2) specified minimum deaths or damages result. Id.

The NRC has begun the necessary procedures to determine whether the TMI-2 accident may be classified as an ENO (44 Federal Register 43128, July 23, 1979). A panel of senior management officials at the NRC has been established to "evaluate public comments, assemble information...and report to the commission its findings and recommendations." (Aug. 30, 1979, The Office of Nuclear Material Safety and Safeguards (NMSS) is responsible for protecting public health and safety, national security, and environmental values in the licensing and regulation of facilities and materials used in the processing, transporting, and handling of nuclear materials. Specifically, NMSS reviews and assesses safeguards against potential threats, thefts, and sabotage.91/

The Office of Nuclear Regulatory Research (RES) plans and implements nuclear research programs for the performance of the NRC's regulatory functions.92/

In addition, the NRC established two nonstatutory program offices: the Office of Inspection and Enforcement (I&E) and the Office of Standards Development (SD). I&E's role is to inspect nuclear facilities and materials licensees to ensure that their construction and operation comply with license provisions and commission regulations. I&E must identify conditions that may adversely affect the protection of nuclear materials and facilities, the environment, or the health and safety of the public; inspect applicants and their facilities to provide a basis for recommending issuance or denial of licenses; investigate accidents, incidents, and allegations of improper actions that involve nuclear material and facilities; and enforce NRC regulations and license provisions.93/

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memorandum from Lee V. Gossick to NRC commissioners). The panel's original deadline was Oct. 22, 1979, but it now "...proposes to submit its report as soon as possible after... review [of] any information relevant to its review presented in the report of the Presidential Commission." Id.

Four of the current NRC commissioners have indicated that, at a minimum, the $560 million liability limit should be increased substantially. (Ahearne deposition at 208-209; Kennedy deposition at 163). A new limit of $1.3 billion has been suggested as a possibility to include the effects of inflation, if nothing else. (Kennedy deposition at 163; Ahearne deposition at 217). Commissioner Gilinsky suggested the complete elimination of any liability limit as currently contained in the Price-Anderson Act, because he does not "think [the nuclear industry] needs this sort of assistance." (Gilinsky deposition at 136-137).

91/ 1978 NRC Annual Report at 262; see also Section 204(b)(1)(2), (A), (B), (C) of the Energy Reorganization Act, 42 USC 5844(b)(1)(2)(A), (B), (C).

92/ 1978 NRC Annual Report at 262; see also Section 205(b)(1)(2) of the Energy Reorganization Act, 42 USC 5845(b)(1)(2).

93/ 1978 NRC Annual Report at 262.

The Office of Standards Development (SD) develops regulations, guides, and standards needed for regulation of facilities and materials with respect to radiological health and safety and environmental protection, and for materials safeguards and plant protection. Standards Development also coordinates NRC participation in national and international standards activities.94/

The Office of the Executive Director for Operations (EDO) is responsible for directing and coordinating the NRC's daily operational and administrative activities and the development of policy options for the commission's consideration.95/

A. THE COMMISSIONERS AND MANAGEMENT FUNCTIONS

The organization chart of the NRC begins with the commission itself. It is a five-member bipartisan panel 96/ with overall responsibility for licensing and regulating nuclear facilities and materials, 97/ appointed by the President of the United States with the advice and consent of the Senate. Much of this responsibility is handled on a day-to-day basis by the NRC staff.

It is the commission's function to "run" the agency 98/ by setting overall policy.99/ The primary role served by the five commissioners lacks exact definition largely because it includes judicial, policy-making, administrative, and executive functions which are not clearly defined and, all too frequently, are in conflict with one another. The commission is expected to act as the "Supreme Court" of licensing 100/, supervise staff personnel, set policy, direct emergency response activities, and administer funds.

94/ Id.

95/ Id.

96/ No more than three commissioners may be members of the same political party. Sec. 201(b)(2) of the Energy Reorganization Act, 42 USC 5841(b)(2).

97/ U.S. Nuclear Regulatory Commission Functional Organization Charts, NUREG 0325, at 3.

98/ Gilinsky deposition at 6.

99/ Kennedy deposition at 5.

100/ Gilinsky deposition at 7.

The five-member NRC was created by the Energy Reorganization Act, which transferred some of the AEC's functions to the NRC. Nearly all of the new commission's staff and functions were drawn from the Regulatory Division of the AEC.101/ The statute granted each commissioner "equal responsibility and authority in all decisions and actions of the Commission."102/

The commissioners tend to be removed from the day-to-day operations of the NRC staff and do not directly supervise staff work.103/ The chairman apparently plays a role in staff supervision, because he does interface with technical and management staff.104/ Still, his position is far from clearly defined. Under the Energy Reorganization Act, the commissioners were to have "equal responsibility and authority in all decisions and actions of the commission." 105/ Subsequently, the law was amended to give the chairman undefined executive and administrative duties as the "principal executive officer of the commission."106/ This ambiguity has led to some confusion.107/

In his deposition, the chairman referred to himself as the "nominal"108/ chief executive officer but, when asked to elaborate, he responded:

> In this agency, we don't really have a chief executive officer in the sense that cabinet departments have a head, and that, for instance, the Environmental Protection Agency has a head... [T]he authorities and power of the head of the agency reside in collegial action, not the chairman... [T]here is ... not a single head of the agency in the sense that there is in most other sections.109/

101/ Senate Report 93-980, 93rd Congress, 2nd Session, reproduced in Volume 1 of D. Diggins, U.S. Nuclear Regulatory Commission, Legislative History of the Energy Reorganization Act of 1974.

102/ Sec. 201(a)(1) of the Energy Reorganization Act, 42 USC 5841(a)(1).

103/ Bradford deposition at 8; Kennedy deposition at 5.

104/ Hendrie deposition at 16.

105/ Sec. 201(a) (3) of the 1975 Amendment, Public Law 94-79, 42 USC 5841(a) (3).

106/ Section 201(a) (2) of the 1975 Amendment, Public Law 94-79, 42 USC 5841(a) (2).

107/ Staff Report to the Chairman of the Joint Committee on Atomic Energy on Allegations Concerning Nuclear Safety, Dec. 3, 1976, at 8.

108/ Hendrie deposition at 6.

109/ Id. at 7-8.

The "five equals" language in the statute, the ambiguity in the definition of the chairman's responsibilities, and the inclinations of the present commission members all combine to create the commission's "collegial operation." 110/ This format results in inefficiency in "a managerial sense." 111/ At least one NRC commissioner feels that this inefficiency could be corrected "to a very large extent by a greater concentration of the executive authority in the hands of the chairman," plus the willingness of the remaining commissioners to "cede a little bit of their own wishes, much less their authorities, to him."112/ Another commissioner proposes a more drastic solution: replace the commission with a single manager.113/

This "confused management structure" 114/ is further complicated directly below the commission level. Although there may be no "single head" of the NRC, there is created by statute an executive director for operations (EDO) who serves at the pleasure of the commission. 115/ The statute fails to define his job responsibilities precisely, but some guidance may be gleaned from a Congressional Conference Report on the 1974 Act:

> [I]t is expected that the Executive Director for Operations will be the coordinating and directive agent below the Commission for the effective performance of the Commission's day to day operational and administrative activities. He will coordinate and direct in behalf of the Commission, the operating and administrative units.116/

110/ Id. at 8.

111/ Kennedy deposition at 199. Commissioner Ahearne agrees with Kennedy's view: "Having five somewhat equivalent bosses makes it very difficult to decide how [to] interact with them." Ahearne deposition at 11.

112/ Kennedy deposition at 199. But note, Kennedy still supports the concept of a commission at the head of the organization. He believes that independence is best achieved by a collegial body that can resist outside "pressures." Id. at 199.

113/ Ahearne deposition at 191-192.

114/ Id. at 10.

115/ Section 209(a) of the Energy Reorganization Act, 42 USC 5849.

116/ Conf. Report No. 93-1445, reproduced in 1974 U.S. Code Cong. & Admn. News at 5549. See also Kennedy deposition at 95-96.

At the same time, the statute, by strictly restricting the EDO's authority, makes it difficult for some of these executive functions to be effectively performed. The EDO is expressly forbidden from limiting the ability of certain other office directors (NRR, NMSS, and RES) to communicate with and report directly to the commissioners.117/

These office directors communicated directly with the commissioners, and bypassed the EDO completely until 1978, when a statutory amendment required the directors to keep the EDO informed of the content of their communications with the commissioners. 118/ Because the EDO is still unable "to suppress or limit information needed for the Commission's discharge of its own collective responsibilities," 119/ the fact that he now is kept abreast of information flowing to the commissioners does little to enhance his managerial power.

The void in management control at the top of the organization is felt at the lower levels, where it contributes to bureaucratic jealousy and an uncooperative attitude between offices. Robert Budnitz, the deputy director of the Office of Nuclear Regulatory Research, noted:

> ...that several offices tend to operate independently of each other, as independent fiefdoms without nearly the interaction at the top as I think is appropriate and this contributes to an attitude in the lower ranks of several offices to the tension [among the various offices].120/

In practice, the EDO has been unable to overcome these statutory constraints and perform as an effective manager. In a recent speech Commissioner Ahearne cited a 1976 staff report of the JCAE:

117/ For example, Section 203 of the Energy Reorganization Act, 42 USC 5843, expressly authorizes the director of Nuclear Reactor Regulation to report directly to the commissioners.

118/ Ahearne deposition at 20-21. The amendment to Sec. 209 of the 1974 Act may be found in P.L. 95-601 Sec. 4(a), 92 Stat. 2949 (1978), 42 USC 5849.

119/ Conf. Report No. 93-1445, reproduced in 1974 U.S. Code Cong. & Admn. News at 5549.

120/ Budnitz deposition, Aug. 27, 1979 at 36-37.

The executive director for operations could not perform as an effective manager because the major offices can bypass him and go directly to the Commission. No one is in a position to manage effectively the Commission's organization and no one is so doing.121/

Commissioner Ahearne believes this problem continues today.122/ Office directors frequently operate independently of the EDO, without input or coordination. The executive director is "an ill-defined individual in the middle," 123/ caught between the commissioners and the directors, and lacking the technical expertise to direct the NRC staff. Executive Director Gossick has himself stated that he would not presume he was in a position to judge the adequacy or propriety of a determination made by the technical staff within NRR.124/ This disarray led Commissioner Ahearne to conclude that "[f]rom an organizational standpoint, I think it is a mess."125/

Commissioner Gilinsky put it more delicately, stating that the EDO's functions need to be "exercised a good deal more vigorously than they have been in the past."126/

B. THE COMMISSIONERS AND LICENSING: EX PARTE RULES

The NRC's responsibility for the licensing of plants is to protect the public health and safety from undue risk.127/ The NRC commissioners serve as the "Supreme Court" of Nuclear Licensing and in so doing, may exert final review over all licensing decisions made by the licensing b,ards.128/ The commissioners may decide to review a decision

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121/ Staff report to the Chairman of the JCAE on Allegations concerning nuclear safety, Dec. 3, 1976, at 8; Ahearne deposition at 19-20. This is not a universal conclusion. See Bradford deposition at 11: "The mere fact that the other office directors can speak to the Commissioners, especially given that they are under obligation in almost every instance to keep the EDO informed of those conversations I don't think cuts into his ability to manage the organization."

122/ Ahearne deposition at 20.

123/ Id. at 21.

124/ Gossick deposition at 85.

125/ Ahearne deposition at 21.

126/ Gilinsky deposition at 162-163.

127/ Kennedy deposition at 19, 109-110, 176; Gilinsky deposition at 6, 161.

128/ Gilinsky deposition at 7.

on their own motion or at the request of a party.129/ Review is appropriate for only those decisions that involve an "important matter."130/ In practice, the commissioners rule on less than 25 percent of those cases adjudicated by the NRC.131/

As previously noted, during the AEC's review of the Fermi reactor in 1956, there was concern that AEC's dual role as promotor and regulator created a potential conflict of interest. 132/ A separate staff was created within AEC to prepare the case to ensure impartiality. This staff acted independently of and did not communicate informally with the commissioners regarding the merits of the case.133/ It was felt that, by separating the staff reviewing a license application from the rest of the agency and prohibiting informal communication, conflict of interest charges could be avoided. 134/ This ex _parte_ communication rule was formally adopted by the AEC in 1962.135/ In 1974, the NRC was created out of the AEC to be an independent agency without any promotional role, thereby removing the potential for conflict of interest. Yet, the ex _parte_ and separate staff rules were retained by the NRC, partly as the result of "bureaucratic organizational inertia."136/ These rules remain in existence today.137/

129/ See 10 CFR 2.762, 2.786 (1979). The commissioners receive a memorandum from the Office of General Counsel on each ASLAB Decision. They do not, however, formally review all such decisions. See memorandum of Sept. 24, 1979, from Leonard Bickwit, Jr., general counsel, to Commissioners Kennedy and Bradford.

130/ 10 CFR 2.786(4)(i),(ii). (1979).

131/ Commissioner Bradford estimates that the figure is closer to 15 percent (Bradford deposition at 19). The higher, 25 percent, figure is from NRC's general counsel, and is computed as a percentage of the decisions of the ASLAB. The figure is misleadingly high, in part, because a number of the decisions do not represent significant adjudicatory events and include expert decisions. If computed on the basis of all cases adjudicated by the ASLAB, whether or not reviewed by the ASLAB, the percentage ruled upon by the commissioners is lower. See memorandum from Leonard Bickwit, Jr., general counsel, to Commissioners Kennedy and Bradford, dated Sept. 24, 1979.

132/ Rolph, supra, at 40-41.

133/ Id. at 40.

134/ Id. at 43.

135/ 10 CFR 2.719 and 2.780.

136/ Gilinsky deposition at 8.

137/ See, 10 CFR 2.780, 2.719; Jensch, supra, at 14-15.

The NRC's current ex parte rule provides:

> [N]either (1) Commissioners, members of their immediate staffs, or other NRC officials and employees who advise the Commissioners in the exercise of their quasi-judicial functions will request or entertain off the record except from each other, nor (2) any party to a proceeding [relating to a license permit] ... shall submit off the record...any evidence, explanation or analysis or advice... regarding any substantive matter at issue in a proceeding on the record then pending before the NRC.138/

This has been interpreted by the NRC legal staff to mean that parties to a proceeding, including the NRC regulatory staff, may not communicate ex parte with the commissioners, or their staffs, once a matter is noticed for hearing. 139/ Significantly, such communication is permitted between the commissioners and the regulatory staff, but not between the commissioners and the applicant, on issues relating to an uncontested application for initial licensing.140/

The ex parte rule applies only to adjudicatory proceedings, that is, "any application or matter which has been noticed for hearing or concerning which a hearing has been requested."141/ One explanation for

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138/ 10 CFR 2.780(a) (emphasis supplied).

139/ See Kelly, "Legality and Propriety of Certain Communications Between Members of the Nuclear Regulatory Commission and Outsiders Concerning Commission Business," NRC internal document, written at the request of former NRC Commissioner Marcus Rowden, to brief new commissioners on ex parte rules. This document may be found attached to SECY-75-435, Aug. 12, 1975.

140/ 10 CFR 2.780(a).

141/ Id. A similarly cautious approach was exhibited by the commissioners in their reluctance to discuss during their depositions matters that are subject to pending nonadjudicatory rule-making proceedings. For instance, Commissioner Bradford refused to discuss emergency preparedness because of a rule-making proceeding (Bradford deposition at 93-94). Commissioner Kennedy refused to discuss Class 9 accidents because of a pending rule-making (Kennedy deposition at 25). On March 7, 1979, the NRC proposed a rule dealing with its ex parte communications that is designed to bring its current ex parte rule into compliance with the Government in the Sunshine Act, to codify its current practices in adjudicatory proceedings, and that makes clear that the current ex parte rule does not apply to nonadjudicatory informal rulemaking proceedings (44 Fed. Reg. 12428, 12429, March 7, 1979).

this approach may be the evolving and uncertain case law in this area. Courts have recognized that ex parte communications may be prohibited by constitutional guarantees of procedural due process in proceedings that resolve competing private claims to a valuable privilege.142/

The practical effect of these rules is to preclude the NRC commissioners from involvement in the licensing process for any particular plant until and unless the individual application is presented to or taken up by the commissioners. Information on other pending matters is concealed from the commissioners since it may come before them at some subsequent date.143/ In fact, the ASLAB was created by the commissioners and invested with authority to render final licensing decisions as a means of isolating themselves from the licensing process:

> It is in this creation (of ASLAB) that the commissioners most effectively sealed themselves off from direct knowledge and involvement in the licensing process. While the commission did also establish some elaborate rules to prevent, or at least record, **ex parte** discussions in cases or proceedings with commissioners and personnel involved in decisional work, the appeal board arrangement was a more effective buffer to keep the commissioners uninformed regarding their responsibilities...
>
> With such a transfer of authority by the Commission, and the limited appeal provisions, the Commissioners created a shield that permitted them to let the appeal boards do all the work which the Commissioners had been appointed to do.144/

In some instances, the commissioners are so effectively insulated that they learn of events within their jurisdiction only from press accounts. For example, Commissioner Bradford learned from a newspaper story that an NRC inspector had alleged he was fired for bringing up safety concerns. Bradford was reluctant to follow up on the story, however, because he was concerned that proceedings involving the incident might eventually be brought before him in his adjudicatory role.145/

142/ See Home Box Office v. F.C.C., 567 F. 2d 9 (D.C. Cir.), cert. denied, 98 S. Ct. 111 (1977); Action for Children's Television v. F.C.C., 564 F. 2d 458 (D.C. Cir. 1977); and case comments on these decisions in 46 George Washington L. Rev. 442 (1978).

143/ Cf. Bradford deposition at 14-15.

144/ Jensch, supra at 14-15, 18. Regarding ASLAB powers, functions, and procedures, see 10 CFR 2.714 and Appendix A-IX (a) of 10 CFR 2.913 and 10 CFR 2.785.

145/ Bradford deposition at 15.

Some of the commissioners have expressed concern that the ex parte rules inhibit their ability to manage effectively by keeping them unfamiliar with individual licensing cases.146/ This is especially true, according to Commissioner Gilinsky, when the commissioners are considering changes in the licensing process:

> [B]eing separated from the ongoing licensing process... has kept the Commission from having any kind of ready familiarity with what the problems were that would have enabled it... to act to modify the process.147/

Indeed, Chairman Hendrie labeled the rules "tremendously frustrating," and stated:

> It means that Commissioners who are occasionally prodded by Congressmen, members of the public, [and] learned counsel for Presidential commissions as to why they are not more down in the bowels of [the] safety machine here, one of the answers is that for certain of those getting down in the bowels of the machine activities, it would be a violation of the United States Code.148/

Hendrie was apparently referring to the restrictions on ex parte communications found in the Administrative Procedure Act (APA).149/ This act forms the basis for the NRC regulations. But the ex parte rules in the APA are substantially narrower than those formulated by the NRC. For instance, the APA does not apply to applications for initial licenses150/, but the NRC's restrictions on ex parte communications do apply to such applications when they are contested.151/ Furthermore, the APA restricts its prohibition on ex parte communication only to those employees or agents who are "engaged in the performance of investigative or prosecuting functions."152/ This limitation is not found in the NRC regulations.153/

146/ Id. at 14; Hendrie deposition at 15-16.

147/ Gilinsky deposition at 8, as corrected by errata sheet.

148/ Hendrie deposition at 11.

149/ The relevant sections of the APA are 5 USC 554, 556, 557.

150/ 5 USC 554 (d).

151/ 10 CFR 2.780 (e).

152/ 5 USC 554 (d) (2).

153/ Contrast these rules, for example, with those of the Federal Trade Commission, whose ex parte prohibitions apply only to investigators and prosecutors. See 16 CFR 4.7.

Instead, the NRC's *ex parte* rules treat the commission staff as a party and, therefore, prohibit communication between the staff and the commission.154/

More important, no provision of the APA specifically prohibits "off the record" discussions between commissioners and the staff of their agency. Ex *parte* communication is prohibited between parties to a proceeding and adjudicators.

The primary justification for the present rules is preservation of the commissioners' impartiality. But, as Commissioner Bradford points out, if the role of the staff were changed, the ex *parte* rules could also be changed without too much difficulty:

> [One] way to do it... is to change the staff role in the licensing process a great deal. On the Maine Public Utilities Commission, we simply drew the ex *parte* lines very differently. The staff was... free to communicate and the Commission could communicate with the staff and vice versa. The *ex parte* rules applied between the staff and the outside world. There is something to be said for giving the staff a more neutral role in our licensing proceedings and permitting more open communication and more direct management between the Commission and the staff.155/

The commissioners are insulated from staff contact in informal ways as well. Not only do staffers refrain from discussing any "substantive matter at issue" because of the ex *parte* rules, but there is also evidence to suggest that staffers avoid even "informal" contact with individual commissioners.

According to Roger Mattson, the director of the Division of Systems Safety (DSS) within NRR, the NRC has a "sort of standing policy" that individual commissioners should not instead "formalism in communication" is used to ensure that all commissioners have equal opportunity and access to information. By "encouraging equality in the information provided by the staff to the five commissioners," the staff is discouraged from seeking opportunities to discuss informally potential areas of interest with individual commissioners. In the 2 years Mattson has served as director of DSS, he has only had such informal contact with any commissioner on only two occasions. 156/ Furthermore, the physical distance between the commissioners in Washington and the staff in Maryland exacerbates the communications breakdown.157/

154/ See 10 CFR 2.780.

155/ Bradford deposition at 95-96.

156/ TMI Commission hearings, Mattson testimony, Aug. 22, 1979, at 308; see Bradford deposition at 211.

157/ Ahearne deposition at 11.

In a recent speech, Commissioner Ahearne summarized the relationship between the commissioners and their senior staff by comparing it to international diplomacy:

> The relationship between the staff and what ostensibly are the senior management, that is, the Commissioners, can be viewed as the relationship between two neighboring countries, in which messages are exchanged in a fairly formal manner with careful review of their substance and particular focus placed upon their style. Relationships appear to be viewed as satisfactory if hostility does not break out and it is entirely acceptable for progress to be made very slowly, if at all.158/

The strained communication system within NRC -- based on both formal ex parte rules and informal policies -- combined with the lack of clearly defined management responsibilities, results in a commission that is insulated from the day-to-day operations of its staff. Specific examples of this insulation were provided in the commissioners' deposition testimony:

- TMI-2 was licensed with 14 "open safety items," including further evaluation of small-break loss-of-coolant (LOCA) analysis. Commissioners Bradford and Kennedy were not aware of this fact until after the license was issued and Kennedy now believes that TMI-2 should not have been licensed with such open items-159/

- The Division of Operating Reactors (DOR) is reluctant to accept responsibility for a plant from the Department of Project Management (DPM) when such open items have not been resolved. Commissioners Ahearne, Bradford, and Gilinsky were not aware of this problem.160/

- Executive Director Gossick was unaware of the Davis-Besse transients until after the TMI accident. Commissioner Ahearne did not know that Roger Mattson was so concerned with the Sept. 24, 1977, Davis-Besse transient that he sent Gerald Mazetis to the site, where he met with 32 people to discuss the significance of the transient.161/

- After the TMI-2 accident, Paul Collins, Chief of the Operator Licensing Branch, recommended that every B&W plant operator be examined by the NRC, as well as the pertinent utility, but

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158/ Speech by Commissioner Ahearne to the National Energy Resources Organization, Washington, D.C., June 24, 1979, at 14.

159/ Ahearne deposition at 121; Bradford deposition at 75; Kennedy deposition at 41.

160/ Ahearne deposition at 123-124; Bradford deposition at 75-76; Gilinsky deposition at 145.

161/ Ahearne deposition at 66; Gossick deposition at 57, 64-65.

this recommendation was rejected at a higher level within NRR. Instead, only spotchecks were instituted. Commissioner Bradford was not aware of this original recommendation or of its subsequent rejection.162/

- The significance of the Davis-Besse transient was recognized by the utility involved, Toledo Edison, and its operators were instructed to give special attention to the hazards of relying on pressurizer level instrumentation when a leak in the top of the pressurizer existed. Chairman Hendrie was not aware that Toledo Edison had taken these steps until he was so informed during the deposition taken by this Commission's staff.163/

- Jesse Ebersole of the ACRS and Carlyle Michelson raised generic concerns about deficiencies that may make it difficult to achieve natural circulation under potential accident conditions. Commissioner Bradford was not aware that these men had raised these problems. Although Commissioner Kennedy was aware that Ebersole had raised them, he did not know that the configur'tion of the Westinghouse steam generator could prevent the correction of the problem.164/

- The NRC does not maintain operating histories of problems with particular operating components, although it does maintain a computer file of LERs. Commissioner Kennedy was "surprised to hear that maintenance histories don't exist."165/

These examples highlight a problem that became apparent throughout the depositions: the commissioners lack detailed knowledge of the NRC's licensing and regulation activities, including some relating to the safety of nuclear power plants. This raises serious questions about the information flow within the agency, the structure of the organization, and finally, the degree to which the NRC is managed effectively by commissioners, who are expected to be both managers and adjudicators.

C. THE COMMISSIONERS AND THE EMERGENCY RESPONSE

By the end of Wednesday, March 28, 1979, the five commissioners, after some contact with the NRC staff, were generally convinced that "things were reasonably stable," and that the Three Mile Island incident "was not all that serious a matter."166/ The commissioners probably

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162/ Bradford deposition at 101.

163/ Hendrie deposition at 168-170.

164/ Bradford deposition at 81; Kennedy deposition at 196.

165/ Kennedy deposition at 139.

166/ Id. at 183.

"knew as much as anybody" at the time.167/ Two days later they began to realize how wrong they had been.

The communications problems, the confusion among the commissioners and NRC senior staff, and the details of the emergency response are described in other portions of this report and in the report on the response to the accident. 168/ Such problems during the crisis period reflect a lack of planning. Indeed, the existing NRC emergency plans did not envision any specific role for the commissioners themselves.169/ Even so, by Friday morning, March 30, it was the commissioners to whom the state officials turned for the official NRC response. Although NRC staffers recommended evacuation, no action was taken in Pennsylvania until Gov. Thornburgh talked to NRC Chairman Hendrie. 170/ Hendrie did consult with the rest of the commissioners. 171/ At the time, Hendrie did not know precisely how many people lived in Middletown, or the availability of access routes. Nor was he familiar with the provisions of the various existing emergency plans (e.g., those of the Pennsylvania Emergency Management Administration, the Pennsylvania Bureau of Radiation and TMI). He was only generally aware of the nature of the surrounding terrain. 172/ Understandably, Hendrie described his evacuation discussions with Gov. Thornburg as "a couple of blind men staggering around making decisions."173/

A number of the commissioners. now recognize the difficulty of making group decisions during a crisis. Much of their time together during the emergency was spent in "educational sessions," because only Hendrie was a "nuclear reactor professional," who could recognize the ramifications of some of the technical problems. 174/ Commissioner Kennedy has suggested that the emergency response be directed by one person -- "Somebody has got to be put in command and it has to be one fellow" -- while the staff and the commissioners support him:

167/ Id. at 187.

168/ See "NRC Emergency Response," Section VIII of this report, infra; also, Report of the Office of Chief Counsel on the Response to the Accident, prepared for the President's Commission.

169/ "There had not, in the agency's emergency planning, been any particular thought that, or provision for, commissioner involvement in the emergency team actions." (Hendrie deposition at 231.)

170/ See Report of the Office of Chief Counsel on the Response to the Accident, prepared for the President's Commission.

171/ Hendrie deposition at 223.

172/ Id. at 228-229.

173/ Telephone conversation between Harold Denton, Lee Gossick, Joseph Fouchard, Brian Grimes, and the Commissioners, beginning 9:37 a.m., March 30, 1979, taken from transcripts of commissioners' meetings at 14.

174/ Hendrie deposition at 234, 235.

> I don't think that the Commission ought to be in the business of trying to manage crises. It ought to be in the business of interfacing with the public. . with the Congress and others. . . . Its principal function, therefore, is to be sure that the support of those in charge. . .is provided. 175/

On the other hand, according to one commissioner, leaving final authority during an emergency to a collegial body may not significantly hinder the emergency response, especially if procedures exist for delegating authority, if necessary; a collegial response may allow for a more rational approach if time permits; and it leaves transcripts which reveal the decision-making process during the crisis.176/

Either way, the need for a plan which allocates responsibility and establishes priorities during an emergency is readily apparent. In fact, the NRC has already been asked to consider developing such a program. 177/

175/ Kennedy deposition at 190-191; see also, Harold Collins deposition at 81-82.

176/ See Bradford deposition at 178-181.

177/ Memorandum of May 30, 1979, from Commissioner Bradford to Commissioners Hendrie, Gilinsky, Kennedy, and Ahearne. (Exhibit 7, Bradford deposition.)

IV. PLANT LICENSING

INTRODUCTION

Like the AEC before it, the NRC employs a two-step formal procedure for licensing commercial reactors. Generally, a construction permit (CP) is granted before plant construction can proceed and an operating license (OL) is issued before fuel can be loaded.178/

For the AEC,

> The rationale behind dual licensing requirements was straightforward... [T]he investments a utility must make in land acquisition and design were so great that, without some formal approval early in the application process, no utility would risk the capital required to move to the operating license stage.179/

The AEC's two-step process actually consisted of a pre-application planning and discussion stage, the filing of an application for a CP, a staff review, an ACRS review, a hearing, plant construction, the filing of a second application (for an OL), followed by additional reviews.180/

The licensing and the construction of a reactor could take 9 to 10 years.181/ Some complained that the AEC's process took too long, and that licensing was a source of unnecessary delay. Others complained that the process entailed no effective design safety review. For example:

> Nuclear technology was evolving so rapidly that construction permit applications could include only the most general description of the reactors... .The more difficult, unresolved problems [were] inevitably

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178/ See, e.g., 42 U.S.C. Sec. 2235; 10 CFR Sec. 50.35, 50.57; 1978 NRC Annual Report at 18, 262, "Regulation of Nuclear Power Reactor and Related Facilities" (Atomic Energy Law Journal, Vol. 16, 1974), at 256-257; H. Green, "The Nuclear Power Licensing Mess" (The Record of the Association of the Bar of the City of New York, Vol. 33, 1978) at 489 (hereinafter cited as Green, "The Nuclear Licensing Mess").

179/ Rolph, supra, at 37.

180/ "Regulation of Nuclear Power Reactors and Related Facilities," supra, at 273-284.

181/ Note, "The Use of Generic Rule Making to Resolve Environmental Issues in Nuclear Plant Licensing," 61 Va.L. Rev. 869, 877, hereinafter cited as "Note, 'Generic Rulemaking.'" One commentator states that between 1966 and 1972, "apparent difficulties with one particular supplier, Babcock & Wilcox, increased the average construction time of all plants built during the six-year period by thirteen months." Rolph, supra, at 125.

> deferred at the construction permit stage .... The plant was virtually completed before staff conducted its full operating license review. By that time changes were difficult and extremely expensive... [yet] there was little doubt at this point that the plant would ultimately be granted permission to operate.... 182/

The Energy Reorganization Act did not eliminate the two-step licensing process for commercial reactors. There is continuing criticism that the process is too slow. One commentator has suggested:

> Eliminate the present two-step licensing process to the extent that it contemplates two separate administrative proceedings... .The two-step licensing process has always been anomalous and is a source of enormous and unnecessary delay and expense to all of those concerned with the proceeding.183/

Other difficulties with the two-step licensing process have been pointed out. For example:

> In order to obtain a construction permit, it is not necessary for the utility to provide a proposed design for the plant. All that need be done is to promise to meet the vague regulations. The staff's review is merely a verification that the utility has made the promise to meet the regulations and a conclusion that there is reasonable assurance that a design meeting the regulations is capable of being developed.
>
> There is some preliminary or conceptual design information presented in the construction permit application, but the level of detail is such that the Staff commonly refers to this information as "cartoons" or "comic book." In those few instances where some detailed information is provided, the utility is free to change that design after receiving the construction permit. No notification of such changes is required to be made to the NRC unless the change involves the "principal architectural and engineering design criteria." Unfortunately for the public and the regulator, the phrase "principal architectural and engineering design criteria" is not defined in NRC regulations.184/

182/ Rolph, supra, at 36-37.

183/ H. Green, "The Nuclear Power Licensing Mess," supra, at 489. See also, House Report on the Energy and Water Development Appropriation Bill for Fiscal Year 1980 (HR 96-243), at 137-139.

184/ Testimony of Robert D. Pollard before the Subcommittee on. Nuclear Regulation, Committee on Environment and Public Works, United States Senate, March 27, 1979, at 2-3, hereinafter cited as "Pollard."

> By the time the decisionmaking process has reached the operating license stage, [the utility's heavy capital investment] will likely vitiate all but the most compelling intervenor arguments against use of the plant. The maximum Commission response to operating license opposition is likely to be minor adjustments in the facility to ensure its compliance with agency regulations.185/

The NRC's present licensing process actually contains a number of mechanisms which operate to avoid delays. These mechanisms include, among others: unresolved safety concerns that arise in the course of a specific license proceeding are redefined as "generic" issues and placed on a separate agenda, thereby removing those issues from the licensing process; the advisory role of the ACRS prevents it from having a legal effect on licensing -- indeed the ACRS cannot present evidence at the ASLB plant licensing hearings; the NRR staff generally limits design review to "single failure" and "safety-related" analyses, requiring neither planning for nor review of safeguards for accidents entailing multiple system or component failures; NRC design requirements in effect when applications are filed are infrequently "ratcheted" to reflect design safety requirements developed after the license application was filed; and plants obtain operating licenses despite remaining open safety items.186/

A. **AVOIDANCE OF LICENSING DELAY VIA PRE-APPLICATION DEALINGS BETWEEN APPLICANT** AND NRC STAFF

The decision to build a nuclear power plant is primarily a private economic decision, made by a public utility after assessing forecasted demand for electric power and examining the relative capital and operational costs of conventional and nuclear facilities. After having tentatively decided to construct a nuclear plant, the utility contracts with a nuclear reactor vendor and an architect engineer firm for development of a plant design. The utility must also conduct extensive tests and studies of its selected site prior to application for a construction permit.187/

185/ Note, "Generic Rulemaking," supra, at 877.

186/ "Backfitting and ratcheting are AEC jargon. Backfitting refers to the modification of an operating facility. Ratcheting refers to the tightening of applicable standards or requirements for a plant that is still in the design or construction phase. In the latter instance, no retrofitting is actually required, but major design and engineering changes might be required." Rolph, supra, at 59, footnote d.

187/ Note, "Generic Rulemaking," supra, at 874.

The TMI-2 construction permit application (then for Oyster Creek Station, Unit 2) was filed with the AEC on April 22, 1968.188/ Although the AEC's licensing process required two formal steps, the construction permit (CP) and the Operating License (OL), its predominant characteristic in the days of reactor development was "informal cooperation" between the applicant and the AEC staff, and many AEC licensing decisions were made "removed from public view and without any explanatory public record."189/

NRC's formal two-step licensing procedure also is preceded by an informal pre-application phase, during which there is dialogue between NRR staff and the applicant. As described by one of NRC's TMI-2 project managers:

> Frequently, [the utility has] come in to discuss the project, discuss the site, inform us of some of the basic features of the plan to the reactor, things of that kind, and to discuss review philosophy perhaps, things like that, prior to tendering [the application] .... The initial discussions, the pre-tendering discussions, may be a year or two in advance of the actual tendering. It just depends in large measure on the utility involved.190/

During this phase, the NRC staff and the applicant may reach understandings as to siting, general design, and applicable license requirements. 191/ Although this activity can serve to avoid delays that would occur if an incomplete application were filed, or if it contained siting or general design criteria that the staff would consider unacceptable, it occurs out of public view. No notice is given until the construction permit application is formally docketed by the NRC.192/

188/ See Application for Reactor Construction Permit and Operating License, Oyster Creek Nuclear Station Unit 2, April 22, 1968. The amended TMI-2 permit application was filed in April 1978. See application for Reactor Construction Permit and Operating License, Three Mile Island Nuclear Station Unit 2, Docket 50-320, Amendment No. 6, revised March 10, 1969. For a description of the format to be followed in a safety analysis report, see Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants LWR Edition" (Revision 3, November 4, 1978). The TMI-2 construction permit was issued by the AEC on Nov. 4, 1969.

189/ Rolph, supra, at 38.

190/ Silver deposition at 8; see also 10 CFR 2.101(a)(1); 1978 NRC Annual Report at 57.

191/ Silver deposition at 7, 9.

192/ 1978 NRC Annual Report at 18.

One commentator has suggested that:

> License applications should not be docketed until they are complete. A preliminary public hearing should commence very shortly after docketing so that the game of "questions and answers" that is now played behind the scenes in correspondence, visits, and conferences between the NRC staff and the applicant will be played in public. This will make the inquisitorial, prosecutorial, skeptical, demanding role of the NRC staff fully visible to the public and put an end to the present appearance of the NRC staff as the faithful spearbearer and ally of the industry.193/

B. AVOIDANCE OF DELAY AT THE CONSTRUCTION PERMIT PHASE: ISSUANCE OF PRE-PERMIT "LIMITED WORK AUTHORIZATIONS" AND DEFERRAL OF OPEN SAFETY CONCERNS TO THE OPERATING LICENSE STAGE

Once the permit application is considered acceptable, the utility formally files for a construction permit, and pays a $125,000 application fee.194/ When the application is accepted by the staff following an "Acceptance Review," it is "docketed," public notice is given in the *Federal Register,* and copies of the application are provided to appropriate state and local officials and placed in a public reading room.195/ The application for a construction permit is required to include the utility-applicant's Preliminary Safety Analysis Report (PSAR), which then becomes the object of the NRR staff review.196/ However, the PSAR is only a preliminary description of the plant and its safety features. The information it must contain includes a "preliminary" and "summary" description of equipment and structures; an "estimate" of the radioactivity expected to be released annually to unrestricted areas during reactor operations; a "general description" of provisions for packing, storage, and shipment of solid radioactive wastes; a description and safety assessment of the site; "approximate" dimensions of the facility and its "general arrangement;" a "preliminary" analysis of systems to be provided for prevention and mitigation of accidents; a "preliminary plan" for the applicant's organization, training of personnel, and conduct of operations; a description of the Quality Assurance (QA) program; identification of structures, components and systems which require

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193/ Green, "The Nuclear Power Licensing Mess," supra, at 489.

194/ Silver deposition at 7; 1978 NRC Annual Report at 18, 254-255. NRC's assessment of licensee fees was recently reviewed by the Fifth Circuit Court of Appeals. The petitioners complained that the fees were assessed only against the applicants and licensees, whereas the public, as well as the licensees, benefit from the services rendered by the NRC. The challenge was rejected. See *Mississippi Power and Light Co., et. al.,* v. *United States Nuclear Regulatory Commission,* 601 F. 2d 223 (5th Cir. 1979

195/ 10 CFR 50.30, et. seq.; 1978 NRC Annual Report at 18; Silver deposition at 8-9.

196/ Silver deposition at 12; 1978 NRC Annual Report at 18.

research and development to determine the adequacy of design, and a showing that the safety issues involved can be resolved before construction is completed; a showing of the technical competence of the applicant; and a "discussion" of the application's "preliminary" plans for coping with emergencies.197/

Moreover, as was the case under the AEC, utilities tend to keep CP applications "as general and devoid of controversial issues as they could to facilitate the review process."198/

Formal procedures provide that, prior to construction, permit applications must undergo design safety, siting environmental, and antitrust reviews by the staff, a review by the ACRS, and public hearings before a three-member ASLB. However, the NRC may grant a "limited work authorization" (LWA) after a staff review and an ASLB hearing on plant siting and environmental impact, which allows construction of the plant to proceed while review of the CP application is ongoing. This practice has been praised for shaving as much as 7 months off the licensing/construction process. 199/ Thus, while the staff is formally reviewing the CP application, construction of the plant is already under way pursuant to the LWA.200/

197/ 10 CFR 50.34, 5034a; R. Nader and J. Abbotts, The Menace of Atomic Energy (Rev. ed. 1979) at 324; see Atomic Energy Commission, The Safety of Nuclear Power Reactors and Related Facilities, WASH 1250 (July 1973), at 3-12.

198/ Rolph, supra, at 73; see Silver deposition at 9-12; Pollard, supra, at 2-3.

199/ See 1978 NRC Annual Report at 18.

200/ Id. The NRC staff reviews the applicant's PSAR to determine whether the plant design is safe and consistent with NRC rules and regulations; whether valid methods of calculation were employed and accurately carried out; and whether the applicant has conducted his analysis and evaluation in sufficient depth and breadth to support staff approval with respect to safety. When the staff is satisfied that the acceptance criteria of the Standard Review Plan (SRP) have been met by the applicant's preliminary report, a Safety Evaluation Report (SER) is prepared by the staff, summarizing the results of their review regarding the anticipated effects of the proposed facility on the public health and safety. (The Standard Review Plan was initially published in September 1975. For a discussion of the SRP see "Backfitting," Section IV D(6) of this report, infra).

After the staff's SER is completed, the ACRS conducts its review and reports its conclusions to the chairman of the NRC in a letter. Both the staff and ACRS may pose questions to the applicant during the course of these independent reviews (Denton deposition at 5; Ebersole deposition at 10-21). The formal process also requires a public hearing before the ASLB prior to issuance of a construction permit (1978 NRC Annual Report at 18).

Furthermore, the NRC can issue a CP even though the applicant has failed to supply in the PSAR "all of the technical information required to complete the application and support the issuance of a construction permit which approves all proposed design features."201/ A CP may be issued under such circumstances if the NRC finds, among other things, that "such further technical or design information as may be required to complete the safety analysis, and which can reasonably be left for later consideration, will be supplied in the final safety analysis report [FSARJ"202/ provided by the applicant at the OL stage.

The handling of concerns raised by the ACRS during the TMI-2 CP review illustrates delay avoidance by deferral of safety concerns from the CP to the OL stage. In its July 17, 1969, letter regarding the TMI-2 construction permit application, the ACRS noted, inter alia, that:

> The applicant has been considering a purge system to cope with potential hydrogen buildup from various sources in the unlikely event of a loss-of-coolant accident. Additional studies are needed to establish the acceptability of this system and to consider alternative approaches. These studies should include allowance for levels of zircaloy-water reaction which could occur if the effectiveness of the emergency core cooling system were significantly less than predicted. The Committee believes that this matter can be resolved during construction of the reactor.
>
> The Committee reiterates its belief that the instrumentation design should be reviewed for common failure modes, taking into account the possibility of systematic, non-random, concurrent failures of redundant devices, not considered in the single-failure criterion. The applicant should show that the proposed interconnection of control and safety instrumentation will not adversely affect plant safety in a significant manner, considering the possibility of systematic component failure. The Committee believes that this matter can be resolved during the construction of the reactor.
>
> The Committee believes that, for transients having a high probability of occurrence, and for which action of a protective system or other engineered safety feature is vital to the public health and safety, an exceedingly high probability of successful action is needed. Common failure modes must be considered in ascertaining an acceptable level of protection. The Committee recommends that a study be

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201/ 10 CFR 50.35(a).

202/ Id.

made of the possible consequences of hypothesized failures of protective systems during anticipated transients, and of steps to be taken if needed. The Committee believes that this matter can be resolved during construction of the reactor. 203/

In its letter, the ACRS also stated that it "continues to emphasize the need and importance of quality assurance, in-service inspection and monitoring programs, as well as conservative safety margins in design."204/

In its Sept. 5, 1969, supplemental SER, the AEC staff addressed the ACRS letter -- indeed, it was attached as an appendix to the staff report -- stating:

> We will continue to review all the ACRS recommendations with the applicants during... our operating license review of the plant.205/

The staff found the applicant technically qualified to design and construct TMI-2,206/ even though the technical design information required to complete the safety analysis was left for later consideration during the OL stage.207/

C. AVOIDANCE OF DELAY AT THE OPERATING LICENSE PHASE: REMOVAL FROM THE LICENSING PROCESS OF SAFETY CONCERNS BY DEFINING THEM AS "GENERIC"; ISOLATION OF THE ACRS FROM THE LICENSING PROCESS; GRANTING OF OPERATING LICENSES WITH OPEN SAFETY ITEMS

NRR Director Denton terms licensing as a "stylized ritualistic process."208/ Theoretically,

> The function of the [OL] review is to ascertain that the design is up to snuff, whatever it was, and you make the changes that are required to meet the regulations.209/

203/ Letter from Stephen H. Hanauer, Chairman, ACRS, to Glenn T. Seaborg, Chairman, AEC, July 17, 1969, at 2.

204/ Id. at 3.

205/ SER by the Division of Reactor Licensing, Docket 50-320, September 1969, at 74 (emphasis added).

206/ Id. at 76.

207/ Id.

208/ Denton deposition at 5.

209/ Mattson deposition at 173.

However, as has been noted, the operating license review comes:

> ...[A]fter a billion dollar plant has actually been built. As a result, the stakes are exceedingly high ... which tends to skew the attitudes of the participants, if not the...results themselves.210/

> By the time the decisionmaking process has reached the operating license stage, [the utility's] investment will likely vitiate all but the most compelling...arguments against use of the plant. The maximum Commission response to operating license opposition is likely to be minor adjustments in the facility.... 211/

In a November 1977 report, NRC's Office of Policy Evaluation observed:

> ...[B]y the time of OL review, many matters related to plant layout and hardware have been committed, so that there is little flexibility to make substantial changes in plant design.212/

Roger Mattson, director of the Division of Systems Safety -- the division which performs the design safety reviews -- testified that construction of the plant as provided in the construction permit "vir-tually mandates] issuance of an operating license." 213/ In fact, the NRC has never refused to grant an OL to an already-constructed plant.214/

For industry, even the existing two-step licensing process entails undue uncertainty. Based in part on recommendations from industry, an AEC internal study group urged that there be earlier CP reviews, that CP applications be required to contain even less detail regarding plant design, and that there be greater assurance that that which is approved at the CP stage will be approved at the OL stage.215/

Actually, a number of mechanisms operate to insure the granting of an operating license for an already constructed plant. Among these examined below are removal of safety concerns from the OL review process

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210/ M. Rowden, "Licensing of Nuclear Power Plants: Reforming the Patchwork Process" (AEI Journal on Government and Society, January/ February 1978), at 46.

211/ Note, "Generic Rulemaking," supra, at 877.

212/ "Followup on ACRS letters" (Office of Policy Evaluation, November 1977), at 5, hereinafter cited as "OPE Report."

213/ Mattson deposition at 172-173.

214/ Ahearne deposition at 149.

215/ "Report to the Atomic Energy Commission on the Reactor Licensing Program," by the Internal Study Group (June 1969), at 44-46.

by defining them as "generic;" isolation of the ACRS from the on-going licensing process; and granting of operating licenses with open safety items.

1. <u>Removal Of Safety Concerns By Defining Them As "Generic"</u>

An example of the use of the generic classification, by which safety concerns are removed from the ongoing license review, is provided by the staff handling of an ACRS recommendation that certain potential accidents be evaluated prior to commercial operation of TMI-2:

> The Committee recommends that, <u>prior to commercial operation of Three Mile Island Unit 2,</u> additional means for evaluating the cause and likely course of various accidents, including those of very low probability, should be in hand in order to provide improved bases for timely decisions concerning possible off-site emergency measures. The Committee wishes to be kept informed.216/

The staff responded to this ACRS concern by removing it from the TMI-2 ongoing licensing process:

> This matter is being considered as a generic issue ... and as such will be dealt with on this plant and others when a final generic solution is developed.217/

216/ TMI-2 Safety Evaluation Report, Supp. 1, Appendix D, Oct. 22, 1976, at 3-4 (emphasis supplied). The same recommendation appears in the ACRS letter on Davis-Besse. Jan. 14, 1977, letter from M. Bender, Chairman, ACRS, to M. Rowden, Chairman, NRC, at 3 (included in Ahearne deposition exhibit 3, Appendix E, at 3).

217/ TMI-2 Safety Evaluation Report, supra, Supp. 1, at 18-6. Additional examples of safety issues redefined as generic include: inadvertent opening of relief valves during transients (River Bend, Units 1 and 2, CP stage): See 6 NRC 760 (1977); Turbine Missiles, Loc. cit.; "Ginna" Fuel Densification Problem (Point Beach, Unit 2, OL stage): See 6 AEC 491 (1973); Fuel Densification (Point Beach, Unit 2, OL stage) 5 AEC 319 (1972); "As Low as Practicable" Standard of Radioactive Effluents (Alvin W. Vogtle, Units 1 and 2, CP stage): See 2 NRC 404 (1975) and SER, Supp. 1, 18.0; Meltdown Consequences after LOCA when ECCS fails (Shoreham Plant, CP stage), 6 AEC 831 (1973); Pressure vessel integrity evaluation (Shoreham Plant, CP stage) 6 AEC 831 (1973); Health Effects of Radon-222 Emissions (17 proceedings consolidated involving 33 plants, including TMI-2, CP and OL stages): See 7 NRC 796 (1978); Turbine Missiles (North Anna Units 1 and 2, OL stage): See Supplemental Staff SER (Sept. 15, 1978); Potential Post-LOCA Pressure Vessel Failure By Thermal Shock (North Anna Units 1 and 2, OL stage); Behavior of Reactor Fuel Under Abnormal Conditions (North Anna Units 1 and 2, OL stage); Maintenance and Inspection of Plants (North Anna Units 1 and 2, OL stage); Common Mode Failures, Instrumentation to Follow Course of an Accident, PWR pump overspeed during a LOCA, Qualification of New Fuel Geometries, Decontamination of Reactors, Water Hammer (North Anna Units 1 and 2, OL stage). For all foregoing references to North Anna Units 1 and 2, see OL SER, Supplement 7, Appendix D (Aug. 24, 1977) and 8 NRC 245 (1978).

Robert Pollard, formerly an NRC design reviewer and now a critic of the NRC, has described the "generic" classification process in this way:

> Perhaps the most grievous deficiency in the licensing process, and the least understood, is the AEC's and then NRC's treatment of unresolved safety problems. These are problems which apply to either all plants or all plants supplied by the same vendor. The NRC staff adopted a procedure whereby if a safety problem applied to more than one plant, it was not necessary to address that problem in the review of any one single plant. By the simple act of classifying problems as "generic," they were removed from consideration within the licensing process. When I resigned from the NRC in 1976 and informed the public of the existence of the generic safety problems, the secret list of such problems numbered over 200. In January of 1978, in response to a Congressional order, the NRC provided ... a list of 133 unresolved safety problems. The number was reduced by a series of disingenuous techniques. Some problems were combined together and others were redefined as not being unresolved safety problems. In this latter category were those problems where no criteria existed and a standard was being developed to specify those criteria. Also, if a reactor vendor had submitted a topical report to be reviewed by the Staff, the problems discussed in the reports were considered to be part of the "Topical Report Review Program" and were therefore excluded, in a type of bureaucratic "shell game," from the "Generic Technical Activities Program," which is the NRC's euphemism for the unresolved safety problems. Similar bases for removing serious safety problems from the list are described in the minutes of meetings of the NBC's Technical Activities Steering Committee.... The most recent development is the latest annual report submitted to the Congress by the NRC. It lists only 17 unresolved safety problems with the highest priority of importance. The explanation for the drastic reduction is again a "redefinition" of the term "unresolved safety issue."218/

The NRC Staff describes the "generic" question in the following way:

> These issues are sometimes called "generic safety issues" because they are related to a particular class or type of nuclear facility rather than a specific plant. These issues have also been referred to as "unresolved safety issues." However,...such issues are considered on a generic basis only after the staff has made an initial assessment for individual plants and has made a determination that the safety significance of the issue does not prohibit continued operation or require licensing actions while the longer term generic review is underway.219/

218/ Pollard, supra, at 4-5.

219/ NRR, <u>Identification of Unresolved Safety Issues Relating To Nuclear Power Plants,</u> January 1979, at 4 (NUREG-0510); see also TMI Commission hearings, Roisman prepared testimony, Aug. 23, 1979, at 10-13.

> Generic problems by their nature, by their definition, are problems that do not interfere with licensing of plants nor with the continued operation of plants.220/

In a 1977 report, NRC's Office of Policy Evaluation recommended, among other things, increased use of the generic classification:

> ...[w]ider generic rulemaking together with other documentation of generic solutions, could have a stabilizing effect on the licensing process, by removing areas from specific case review and diminising the likelihood of reopening for re-review in light of new insights in later cases.221/

Regardless of the viewpoint one has as to the NRC's purpose in declaring items "generic," the effect of the agency's use of this classification in the TMI-2 licensing process was to negate the ACRS recommendation that the matters be resolved _prior_ to commercial operation of the plant.

2. Limiting the Impact of the ACRS During License Reviews

The ACRS is a statutory committee with authority to advise the NRC on safety aspects of proposed and existing nuclear facilities and the adequacy of proposed reactor safety standards. 222/ As previously noted, the ACRS reviews CP and OL applications and reports on safety hazards it has found. It also is responsible for reviewing generic safety issues, and reports on safety hazards at licensed plants.223/

The impact of the ACRS' role in the licensing process is limited in the first instance by its small size -- 15 part-time members and staff of 20.224/ The lack of firm guidelines and procedures regarding ACRS' own responsibilities225/ further weakens its effectiveness. The ACRS meetings are infrequent (normally, 12 each year) and of limited duration.226/

220/ DeYoung deposition at 45.

221/ OPE Report, supra, at 11 (emphasis supplied).

222/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 115.

223/ NRC Functional Organization Charts, (NUREG-0325), Jan. 1, 1979, at 6; Lawroski and Moeller, "The Advisory Committee on Reactor Safeguards: Its Role in Nuclear Safety," September 1978, at 1-2, 31.

224/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 114, 116-118, 131; Ebersole deposition at 18.

225/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 134-135.

226/ NRC 1978 Annual Report, at 66; Lawroski and Moeller, supra, at 7.

The ACRS, as a matter of policy, does not recommend design changes, because this could result in the ACRS later reviewing the sufficiency of its own design suggestions. 227/ Moreover, the 15 ACRS members each tend to concentrate on their own particular areas of expertise, resulting in fragmented ACRS license review.228/

Although the ACRS' 20-member staff is responsible for following up on concerns raised by ACRS members, its small size dictates that it must often rely upon the NRC staff to do the actual followups. This reliance operates to further lessen the ACRS' role.

In June 1977, the ACRS complained in a letter to NRC Chairman Rowden that little or nothing was being done by the staff to followup on a number of safety concerns raised by the ACRS regarding the Zion Nuclear Stations.229/ In response, the commissioners requested that a report be prepared by the OPE, analyzing staff followup on ACRS concerns. The OPE report, issued in November 1977, observed:

> On a number of recent cases the ACRS had indicated dissatisfaction with the pace of resolution [of generic safety items] and some ACRS members have favored a "fix" being required for a specific plant or a standard - plant action irrespective of the scheme for resolution on a generic basis.230/

The OPE report recommended, among other things,

> Establishing priority for generic resolution of ACRS-identified generic issues that is consistent with schedules for construction permits and operating licenses for specific plants, with schedules for standard-plant design approvals or manufacturing licenses, and with the state of the technology for resolving such issues.231/

A number of examples demonstrate how the absence of clearly defined responsibilities and procedures within the NRC for following up on ACRS-generated concerns weakens the ACRS' role in licensing and plant safety.

227/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 145.

228/ Id. at 114-115.

229/ OPE Report, Appendix B.

230/ Id. at iii.

231/ Id. at v. See the OPE Report, at 3-5, for a description of the procedure by which the ACRS participates in licensing.

The TMI-2 operating license application was filed on Feb. 15, 1974. On Oct. 22, 1976, after the staff had completed its review, the ACRS recommended issuance of an OL for TMI-2, but raised a number of concerns. One was directed at the applicant's failure to delineate safety-related responsibilities for TMI-2 personnel:

> The management organization proposed by the Applicants to delineate the safety related responsibilities of the off-site and on-site personnel of the Three Mile Island Station left open questions as to how these responsibilities are to be discharged during normal working hours and during evening, night, and weekend shifts. This matter should be resolved to the satisfaction of the NRC Staff.232/

The applicant's response to the ACRS' concern was submission of a new organizational description:

> The station staff, under the direction of the Station Superintendent/ Senior Unit Superintendent, is responsible for the operation of both units which are located at the site. The station staff consists of approximately 146 full-time employees functioning in four main groups: an operating and technical group for each unit (about 34 people in each group) responsible for plant operations and technical support in the areas of nuclear engineering, instrument and control engineering, mechanical engineering and electrical engineering; a maintenance group (about 60 persons) responsible for electrical, mechanical and instrument maintenance at the station; and a radiation protection group (about 15 persons) responsible for station radiation protection and chemistry programs.233/

Although this response addressed neither the ACRS concern that safety-related responsibilities were not delineated, nor how the responsibilities were to be discharged, the NRC staff considered the matter "resolved."234/

Another example involves the so-called "Michelson Report." Carlyle Michelson, an engineer with the Tennessee Valley Authority and a consultant to the ACRS,235/ has had a long-standing interest in the consequences of very small-break LOCAs. Specifically, Michelson felt that the computer codes previously developed for analysis of large-break LOCAs could not be

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232/ Memorandum from Dade W. Moeller to Marcus A. Rowden, Oct. 22, 1976, at 3.

233/ Safety Evaluation Report, Supp. 2, February 1978, at 13-1.

234/ Id. at 18-3.

235/ Michelson deposition at 5-6.

simply extrapolated to cover or "bound" small-break LOCAs, and that small-break LOCAs required analysis on an independent basis. He had questioned the traditional NRC design wisdom that large-break analyses bounded the consequences of smaller-break LOCAs.236/

In 1977, Michelson drafted a handwritten report on a Combustion Engineering system, entitled "Decay Heat Removal Problem Associated With Recovery From A Very Small Break LOCA For CE System 80 PWR," in which he outlined his concerns. 237/ Michelson provided a copy of his report to Jesse Ebersole, a member of the ACRS.238/ Ebersole in turn discussed the report with ACRS member David Okrent.239/

Subsequently, Michelson drafted a second handwritten report, dated Sept 1, 1977, entitled "Decay Heat Removal Problems Associated With Recovery From A Very Small Break LOCA for B&W 205 Fuel Assembly PWR." The report largely duplicated the prior Combustion Engineering document, with some further elaboration on the B&W design. Michelson was disturbed by the "rather strange inverted 'U' shape of the surge line between the hot leg and the pressurizer" that would possibly cause coolant to become trapped in the pressurizer, thereby leaving "a partial level in the pressurizer with no fluid in the reactor vessel."240/

Michelson was concerned that a deceptive pressurizer level would, under certain small-break LOCA conditions, mislead the operator into thinking that he had a sufficient level of inventory in the core when he might well not have a sufficient level.241/ He was aware that B&W's prior analysis had not addressed these considerations and he wanted a suitable review by someone within the NRC who was "adequately familiar

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236/ Id. at 11-14.

237/ Id. at 6-9.

238/ Id. at 34-35.

239/ Id. at 35-36. Ebersole also provided a copy of the report to Sanford Israel of the NRC staff. See infra.

240/ Id. at 47. Since the accident at TMI-2 presented this phenomenon, Michelson has argued that the same situation can occur at Combustion Engineering plants in the event of a break at the top of the pressurizer. Id. at 48-51.

241/ Id. at 51. The Michelson Report emphasized the absence of necessary operator instructions: "The Michelson report would have been very substantive in the knowledge that there was no compensatory operator procedure to deal with the physical problem at hand. Had there been...a suitable set of emergency or abnormal procedures, I believe that incident [at TMI-2] could have been handled very easily." TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 126.

with the details of ECCS [emergency core cooling system] analysis."242/ At the end of September 1977, Ebersole provided a copy of Michelson's B&W report, and possibly the Combustion Engineering report, to Sanford Israel, a design reviewer in the Reactor Systems Branch (RSB) of NRC, and an expert on emergency core cooling systems. Israel was selected by Ebersole as the person within the NRC staff most likely to appreciate Michelson's concerns.243/

Ebersole's transmission of the Michelson handwritten report to Israel did produce a tangible result. Reacting to Michelson's concerns and the Davis-Besse transient of Sept. 24, 1977,244/ Israel drafted a memorandum to all members of the RSB, entitled "Loop Seals in Pressurizer Surge Line." On Jan. 10, 1978, this memorandum was transmitted over the signature of the RSB branch chief, Thomas Novak, and a copy was sent to Mattson's deputy, Denwood Ross. It discussed possible instances of prolonged relief valve opening at B&W plants, the formation of voids in the primary system, and creation of a "two-phase mixture" (steam and water) in the pressurizer. The memorandum also warned that additional loss of primary system coolant might not be indicated by pressurizer level which would remain high and deceive the operator into terminating makeup flow.245/

However, the Israel memorandum was not distributed beyond the RSB and Ross. Until TMI-2, the memorandum was not considered to have identified a generic safety problem for operating plants. 246/ The memorandum was instead filed for use only in review of applications for future B&W plants, no instructions to operators regarding misleading pressurizer level were issued, and ACRS member Ebersole was not advised of the memorandum prior to the TMI accident. After the accident, he was provided a copy by a Congressional subcommittee.247/ Moreover,

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242/ Michelson deposition at 54.

243/ Id. at 41-45; Ebersole deposition at 24.

244/ Israel deposition at 58, 63-65.

245/ Id. at 9-11.

246/ TMI Commission hearings, Mattson testimony, Aug. 22, 1979, at 226-228.

247/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 125-126.

although the B&W Midland plant application came before the RSB prior to the TMI-2 accident, the Israel memorandum was not utilized by the reviewer in connection with that review.248/

The Michelson reports also were used by ACRS member Ebersole in late 1977 to draft ACRS questions directed to the applicant in connection with the licensing of the B&W Pebble Springs plant in Portland, Oregon. Question Number 6 was specifically based upon Michelson's concerns:

> Does applicant know that time-dependent levels will occur in pressurizer, steam generator and reactor vessel after a relatively small primary coolant break which causes coolant to approach or even partly uncover fuel pins? <u>What does operator do in respect to interpreting level in pressurizer?249/</u>

In late 1977, the chief of the RSB received the 26 ACRS questions concerning the Pebble Springs license application, including question Number 6. RSB routed the questions to the applicant, received the applicant's replies, and routed those to ACRS. Although RSB had been assigned primary responsibility for question Number 6, RSB did not review the adequacy of the applicant's answers. 250/ Neither the NRC staff nor the ACRS staff followed up. As a result, the question con-

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248/ Newberry deposition at 24, 26-27, 30-32. The final chapter in this story concerns the typed version of the Michelson report, dated January 1978. Having had little success in the submissions of his prior handwritten reports to ACRS member Ebersole, Michelson finalized his B&W report and, after circulating it within TVA for comments, had it submitted to B&W in April 1978. During a conference call in November 1978, it became apparent that B&W did not really understand Michelson's concerns (Michelson deposition at 91). He then sent B&W a telecopy on Dec. 10, 1978, stating his concerns in summary fashion. B&W responded by letter in January 1979, but the letter did not address most of Michelson's points and was internally inconsistent (Michelson deposition at 96-98). A further letter was sent by TVA on Feb. 8, 1979, and a reply was requested by March 15, 1979. However, B&W did not reply until May 29, 1979, and still failed to address some of Michelson's concerns (Michelson deposition at 98-101). According to a recent NRC report by the Office of Inspector and Auditor, the typed version of the Michelson report never found its way to the NRC before the TMI-2 accident. (See Report of Investigation, Office of Inspector and Auditor, NRC, "Michelson Report - Events and Levels of Review," (July 25, 1979), at 1.)

249/ Appendix W, NUREG-0560 (emphasis supplied).

250/ Novak deposition at 54-56. TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 122-131, and exhibit 3 memorandum dated Nov. 15, 1977, to Aug. 22, 1979, TMI Commission hearings.

cerning how the plant operators would interpret pressurizer level during a small-break LOCA went unanswered.251/

An example of an ACRS concern that the staff inadvertently followed up on years after it was raised involves a potential of noncondensible gas, trapped in the top of the primary system tubing in PWR steam generators, interfering with natural-flow cooling of the core. In 1975, an ACRS question addressing the trapped gas problem was directed to the applicant, Pacific Gas and Electric, during license hearings on the Diablo Canyon reactor. Neither the utility nor the vendor (Westinghouse) responded to the question and no effort was made by the NRC staff to follow up.252/

According to Ebersole, the inability to vent trapped gas from the steam generator remains a generic design defect in all PWRs (pressurized water reactors).253/ Although this problem could be solved in B&W plants by installation of vents at the top of the "candy cane" atop the steam generators,254/ no such vents had been installed on or required for B&W plant designs at the time of the TMI-2 accident. Nor could they be on Westinghouse and Combustion Engineering plants, because of the reliance in those designs upon numerous small inverted "U" tubes and tube bundles in the steam generator.255/

The inability to vent gas trapped in the top of the steam generators of PWRs has remained an unresolved safety concern since the question was posed by the ACRS to the Diablo Canyon licensing applicant in 1975.256/

251/ Ebersole deposition at 69-70. See also, Appendix W, NUREG-0560; Michelson deposition at 62-65.

252/ Ebersole deposition at 19-20; TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 127-128.

253/ Ebersole deposition at 47-48, 96-97; TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 127-128.

254/ Ebersole deposition at 47. Accord, English, technical staff analysis report on "Thermal Hydraulics," prepared for the President's Commission.

255/ Ebersole deposition at 47-48, 88; J. Ebersole and D. Okrent, "An Integrated Safe Shutdown Heat Removal System for Light Water Reactors," Nuclear Engineering and Design 41 (1977).

256/ Memorandum by Denton to Commissioners on Aug. 20, 1979, enclosures 1, 3, and 4. The NRC has requested applicants to address the matter of venting of gas from the primary system. The specific matter of venting gas trapped in the steam generators remains unaddressed by NRC. (Id.) See also, Memorandum from D. Vassallo to pending operating license applicants, "Followup Actions Resulting from the NRC Staff Reviews Regarding the Three Mile Island Unit 2 Accident" (Sept. 27, 1979), Enclosure 4, "Installation of Remotely Operated High Point Vents in the Reactor Coolant System," at 2.

The trapped gas problem is not wholly theoretical. Several days following the onset of the Three Mile Island accident, the presence of a large hydrogen gas bubble was detected in the top of the reactor vessel.257/ The bubble was of concern to NRC staffers who believed that radiolysis -- the effect of radiation on the coolant in the primary system -- would produce sufficient oxygen in the reactor vessel to allow a hydrogen-oxygen explosion to occur. Such a detonation, it was feared, would damage the vessel itself system. 258/ For the NRC, the problem posed two questions: (1) how long would it take for sufficient oxygen to be produced for a detonation, and (2) how could the hydrogen gas be removed from the reactor vessel.259/

As to the first question, numerous errors were made in the NRC calculations which supported the view that there would be dangerous levels of oxygen gas in the reactor vessel within a few days.260/ Later it was realized that such factors as the high pressure within the reactor vessel, natural recombination of hydrogen and oxygen into water, and the natural solubility of oxygen in water would all combine to prevent production of the oxygen gas necessary for an explosion.261/

Before the computation errors were recognized, however, NRC attention turned to the second question -- how to remove the hydrogen gas bubble from the reactor vessel. 262/ At one point, NRC considered venting the gas through a long hollow tube, which would have to be snaked through the primary (reactor cooling) system pipes and into the reactor vessel. 263/ Then it was discovered that no guidance device had been developed to direct the tube through the primary system pipes.264/

257/ Budnitz deposition, Aug. 1, 1979, at 11-12.

258/ Id. at 13-15, 31.

259/ Id. at 14-15.

260/ "Chronology of TMI-2 Hydrogen Bubble Concern," (March 31 - April 2, 1979), prepared by Roger Mattson, NRC, as Enclosure 1 to Sept. 6, 1979, letter from Roger Mattson to Stanley Gorinson, Chief Counsel, President's Commission.

261/ Mattson deposition at 177-193; Budnitz deposition (Aug. 1, 1979), at 21-37. See also, English, technical staff analysis report on "Chemistry," prepared for the President's Commission. This topic is discussed in more detail in Section VIII of this report on NRC's actions during the accident, infra.

262/ Budnitz (Aug. 1, 1979) deposition at 15.

263/ Id. at 15.

264/ Id. at 42-43.

NRC also considered adding a chemical to the primary system which would purge the hydrogen gas. However, no satisfactory chemical could be found.265/ They also considered depressurization of the primary system. The theory was that depressurization would allow the hydrogen bubble to expand. When it reached the opening to the pressurizer pipe, a pilot-operated relief valve (PORV) would be opened, and the gas would be vented through the pipe, through the pressurizer, and out of the primary system via the PORV.266/ NRC arranged to have the depressurization-venting solution tested on a small scale simulator in Idaho.267/ During the simulation, the gas bubble did not vent through the PORV upon depressurization. Instead, it migrated to the steam generator, where it got trapped. Recognizing that gas trapped at the top of the steam generator would interfere with natural-flow cooling of the core, the technicians did not recommend depressurization as a means of venting the hydrogen from the reactor vessel. 268/

Finally, ACRS license reviews normally follow the staff reviews and the ACRS relies upon the NRC staff to bring to its attention the difficult safety issues that arise in the licensing reviews of a plant. The NRC staff fulfills this function by routinely providing its SER and other documents to the ACRS upon request. However, the SER is the result of the staff's license review activities and its efforts to eliminate controversial matters in the application. Harold Denton, the director of NRR, believes that his staff's SERs should be helpful to the ACRS.269/ However, ACRS member Ebersole has stated that "the SER tends to obscure issues rather than to bring them forward."270/

ACRS' difficulty **in** injecting generic safety concerns into the ongoing licensing activity is not solely the result of its limited resources and its resultant reliance on the NRC staff, over which it has no authority. 271/ By statutory and organizational design, the ACRS is prevented from having a direct impact on the NRC's licensing decisions. In both plant license reviews and in reviewing generic safety concerns, the ACRS performs solely on advisory role; its concurrence is not required

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265/ Id. at 45-46.

266/ Id. at 15-19.

267/ Id. at 39-41.

268/ Id. at 43-44.

269/ TMI Commission hearings, Denton testimony, Aug. 23, 1979, at 26-27.

270/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 116.

271/ Ebersole deposition at 9, 11-12, 19-20.

for the issuance of a plant license by NRR.272/ Significant ACRS involvement with the Office of Nuclear Regulatory Research (RES) is limited to a Congressional requirement that the ACRS review the research program annually for budgetary purposes. 273/ Also, ACRS members are not allowed to testify at plant licensing hearings conducted by the ASLBs:

> In several cases that have been considered by both the AEC and NRC, endeavors have been made to have the benefit of that ACRS advice in the hearing and decisional record. That has involved the problem of having someone from the ACRS present its report at the hearing, identify it, and be prepared to discuss it or in some manner to explain its contents. Ordinarily, a chairman of a committee would perform that task. Both the AEC and NRC, however, have ruled that the chairman of the ACRS must not be called as a witness because the ACRS report is a determination by consensus, and with varying views, generally, among the 15 member ACRS, no one person should undertake to speak for all of them. That ruling eliminated the use of the ACRS report in the hearings, and since decisions in licensing proceedings must be based upon the record, the [Clommission, by preventing the usual process of receiving evidence to apply to ACRS reports, the net effect is that the ACRS cannot advise the [C]ommission of its views or opinions in nuclear power plant proceedings.274/

There have been efforts to remove the ACRS altogether from the ongoing licensing process. One AEC internal study recommended that:

> The ACRS should be relieved of the obligation to review and report on all applications for power reactor construction permits and operating licenses. The Committee should then gradually reduce its involvement in the reviews of individual applications and concentrate more on [generic safety issues, evaluation of research and operation experience data, and development of regulatory criteria].275/

NRR Director Harold Denton explained the conflict created by ACRS involvement in the licensing process:

272/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 115, 117; Ebersole deposition at 12.

273/ Levine deposition, Aug. 8, 1979, at 67.

274/ Jensch, supra, at 20-22. See also, TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 134-136.

275/ Report to the Atomic Energy Commission on the Reactor Licensing Program (Internal Study Group, June 1969), at 39.

[The ARCS is] usually pushing the licensee to provide a better plant than the last plant and we [at NRR] normally take our charter that if the license application meets existing rules of the Commission, we shouldn't make that licensee do extraordinary forward-looking research in order to improve the Commission's regulations for safety requirements .... So there has been a certain amount of tension on how do we improve the industry ... without making every licensee extend a little bit beyond what the last licensee did and was found acceptable.276/

ACRS member Ebersole sees the matter in this way:

The ACRS could write a letter endorsing a position that a plant not be allowed to be constructed or operated in the face of that generic issue. That would be regarded as punitive in the case of that particular project or generic plant design. In general, that sort of punitive pressure is not brought to bear.277/

The relative isolation of the ACRS from ongoing licensing activities, then, like the practice of removing open safety items from the plant specific licensing process by defining them as "generic" and placing them on a different agenda, results in the removal of obstacles from the ongoing licensing of reactors.

3. Issuance of Operating Licenses with Open Safety Items

Another mechanism employed by NRC that avoids delay in issuance of operating licenses is to issue licenses while open safety items remain.278/ A secondary result of this practice is a jurisdictional confusion between two NRC divisions over responsibility for such plants.

NRR's Division of Project Management (DPM) is responsible for regulating nuclear facilities under construction. Regulation of the plant is supposed to be transferred to the Division of Operating Reactors (DOR) once an OL is issued. 279/ As a practical matter, however, there have been substantial delays between the time that a plant receives an OL and its acceptance by DOR. These delays in acceptance by DOR have been "as long as one year after they were licensed." 280/ The delay is usually due to the existence of open or unresolved safety items

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276/ Denton deposition at 11.

277/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 118.

278/ Mazetis deposition at 18-19.

279/ Silver deposition at 31.

280/ TMI Commission hearings, Stello testimony, Aug. 23, 1979, at 197.

in the plant. In recent years, it has become common practice at the NRC that "some 13 to 15 [open or unresolved safety) items" would exist at the time an OL was issued.281/

DOR believes that a project should be "cleaned up" before it accepts transfer -- it should have a minimum number of outstanding issues.282/ DOR's position has been that the open items should:

> . .. be wrapped up by those who generated the questions originally rather than trying to bring somebody new up to speed and start to reinvent the whole process.283/

During the period of time between issuance of the OL and DOR's acceptance of the plant:

> [T]he licensing project manager [DPM] continues to be responsible for the plant. That responsibility would include assuring satisfaction of license conditions, writing amendments to the license to document removal or satisfaction of these conditions, maintaining contact generally with the utility to assure that it would be aware of what is happening in the start up procedures that are ongoing after issuance of the license.284/

In effect, once an OL is issued to a plant with open items, DPM assumes DOR's role of regulator. This role includes DPM's "keep[ing] a close tab on safety problems as they arise" by reviewing operating reactor LERs.285/ However, DOR, not DPM, is the office with the expertise necessary for resolving technical problems that plants encounter once they begin operation. 286/ A plant with an OL that has not been transferred to DOR is, according to Roger Mattson, NRR's director of Systems Safety:

> ...in a diminished state, [it] doesn't have the full attention that DOR pays to a normal operating reactor, nor does it have the full attention that DPM pays to a normal plant under construction. The focus of DPM is the granting of licenses and the priorities and

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281/ Silver deposition at 30; Mattson deposition at 235-237; Eisenhut deposition at 24-25.

282/ Eisenhut deposition at 19-19a.

283/ Id. at 20.

284/ Silver deposition at 31.

285/ Id. at 31-33.

286/ Eisenhut deposition at 26.

resources are set to meet those ends, so it is in limbo. That is an overstatement, but it is somewhere between full attention in DPM or full attention in DOR.287/

According to the NRC staff, this practice is justified for two reasons. First, "the interests of the consumers [are served], they get the power out to the consumer quicker."288/ Second:

> ...[t]here are some [unresolved safety items] that are important enough to shut a plant down, and some that are not. We like the ones even though they are not important enough to shut a plant down, some require them to be done, we give people a reasonable time to implement them. If you give an operating plant a reasonable time to implement them and you have got another plant that is finished construction and is ready to operate, why shouldn't he have a reasonable time if it can be shown there is no radiation consequence to workers as a result of giving him the opportunity to go into operation before the change is accomplished? ...the decision usually is to let them go into operation.289/

In other words, if an older plant is currently operating with a design similar to a plant that has just received an OL, but with open items, the NRC's choice is to allow the newly licensed reactor to operate and close out the safety items later.

DSS Director Mattson argues for "consistency" in this approach to licensing:

> ...[I]f you can allow [reactors] to stay in operation and be truthful that it is not that important a safety problem, and if it is that important a safety problem, then be truthful and shut them down until they get it fixed on all of them, not just the one that is waiting to go into operation.290/

However, if no intervenors raise the issue, and if the commissioners do not raise it, the NRC staff alone decides what open items should be resolved before OL issuance.291/

NRR Director Denton's testimony before this Commission in August 1979 revealed similar reasoning in his decision to resume plant licensing, including the issuance of OLs:

287/ Mattson deposition at 240, as corrected by errata sheet.

288/ Mazetis deposition at 19.

289/ Mattson deposition at 236-237.

290/ Id. at 238, as corrected by errata sheet.

291/ Kennedy deposition at 45-46.

> ...I have trouble distinguishing between duplicate plants at the same site in terms of their health and safety impact, and it seems to be consistent, if I am going to permit Salem I to continue operation, I should let Salem II go into operation.... 292/

Denton's decision to resume licensing activity was made despite recognition by NRC of serious inadequacies in the licensing process itself. For example, the guidelines for application of the SRP by NRC license reviewers remained inadequate. 293/ The problem of training operators to distinguish between transients so as to discern which set of procedures are to be followed had not been resolved;294/ concerns posed by the TMI accident about the B&W's once-through steam generator design (OTSG) versus the recirculation steam generator (RSG) had been eased but not resolved; 295/ the question of hydrogen gas control in the containment building had not been resolved;296/ regulation of control room design had not been resolved;297/ backfitting requirements for emergency procedures had not been implemented;298/ NRC's practice of merely spotchecking or "auditing" utility operator training program remained299/ a safety concern that gas trapped in the steam generators of pressurized water reactors (PWRs) could interfere with core cooling remained unsolved; and despite its recognized inadequacies, single failure analysis remained the basis of design review for plants coming up for license issuance.300/

On Oct. 4, 1979, in response to Denton's decision to resume the licensing process, the NRC issued an interim policy statement to "clarify the [C]ommission's previously announced policy decisions on how licensing proceedings should be conducted...." until the various investigations of the NRC have been concluded. 301/ No further construction permits, limited work authorizations, or operating licenses for

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292/ TMI Commission hearings, Denton testimony, Aug. 23, 1979, at 46.

293/ Id. at 98.

294/ Id. at 79, 82.

295/ Ahearne deposition at 154.

296/ TMI Commission hearings, Denton testimony, Aug. 23, 1979, at 44-45.

297/ Ahearne deposition at 171.

298/ Hendrie deposition, exhibit 6.

299/ TMI Commission Hearings, Denton testimony, Aug. 23, 1979, at 65.

300/ Hendrie deposition at 44-47, 49; see discussion of Design Basis Analysis, Section IV D(2) of this report, infra.

301/ U.S. Nuclear Regulatory Commission, "Interim Statement of Policy and Procedure," Oct. 4, 1979.

nuclear reactors will be issued until the NRC commissioners have reviewed them. Simultaneously, the commission is reviewing its regulatory system to determine what, if any, modifications should be made.302/

In the case of TMI-2, an operating license was issued Feb. 8, 1978, but in September 1978, there were still 14 unresolved safety items. On Sept. 19, 1978, DPM requested transfer of TMI-2 to DOR, but DOR refused. 303/ At the time of the March 28, 1979, accident, TMI-2 was still formally assigned to DPM.304/ Indeed, the plant was not transferred to DOR until Aug. 22, 1979.305/ DOR's refusal to accept responsibility for TMI-2 was based on the:

> ...significant number of unresolved technical areas requiring at least some staff involvement.. .[and] ... a manpower consideration in terms of whether the requisite number of project managers were available at the time to take the transfer. At that time they were not.306/

Unresolved item 11 of DPM's Sept. 19, 1978, memorandum concerning TMI-2, entitled "Small-Break LOCA," illustrates the difficulties which may be encountered in closing out open items. Item 11 noted that an analysis dealing with the problem of adequately correcting for a small-break LOCA on the discharge piping of the reactor coolant pump had been performed by the vendor (B&W) and supplied to the NRC in April 1978. B&W provided a report to Met Ed, the licensee, dated May 1, 1978, that required operator action to mitigate the postulated accident. An analysis was submitted to the NRC by Met Ed to justify plant operation at 80 percent power, with a promise to provide further analysis by June 1, 1978, for operation at full power. Met Ed further promised to provide "a permanent solution to the question of operator action by Aug. 5, 1978."307/ This item ends with the assignment of review of Met Ed's

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302/ Id.

303/ Memorandum from Steven Varga to distribution, Sept. 19, 1978.

304/ TMI Commission hearings, Stello testimony, Aug. 23, 1979, at 199.

305/ Letter from Victor Stello, Jr. to Stanley M. Gorinson, Sept. 7, 1979, Enclosure 1.

306/ Eisenhut deposition at 24; memorandum from V. Stello, Jr. to D. Vasallo, Sept. 26, 1978.

307/ Memorandum from Steven A. Varga to distribution, Sept. 19, 1978, at 4.

promised permanent solution to DOR.308/ Investigation by this Commission indicates that this B&W report on operator action to deal with the postulated LOCA led Met Ed to adopt a misleading operating procedure which contributed to the TMI-2 accident.309/

Finally, according to Victor Stello, former director of DOR, it is DOR's function to assure that current operating experience is factored into the licensing process.310/ However, that charge only applies to reactors formally assigned to DOR.311/ DOR does not factor operating experience of plants that are still within the jurisdiction of NRR's

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308/ Id. Commissioner Gilinsky recently observed that it is not good practice to have OLs issued with open safety items of such significance as small-break LOCA analysis (Gilinsky deposition at 145). See also, Kennedy deposition at 45; Bradford deposition at 74-79.

309/ See, R. Eytchison, technical staff analysis report on "Selection, Training, Qualification, and Licensing of Three Mile Island Reactor Operating Personnel," prepared for the President's Commission, at 154-157.

310/ TMI Commission hearings, Stello testimony, Aug. 23, 1979, at 195-196. See also NUREG-0325, Jan. 1, 1979 at 35.

311/ TMI Commission hearings, Stello testimony, Aug. 23, 1979, at 204, 205.

Division of Project Management (such as was Davis-Besse-1 in 1977, and TMI-2 in March 1979) into DOR's regulatory efforts.312/

D. AVOIDANCE OF DELAY IN THE LICENSING PROCESS -- SCOPE OF THE DESIGN SAFETY REVIEWS

The NRC's prescribed design safety review is not a review of all of the systems and components of the nuclear plant, but only of those items deemed safety-related. As a matter of regulatory practice, NRC does not review designs for prevention or mitigation of accidents involving independent failures of more than a single component or system (such as occurred during the TMI-2 accident); it is not concerned with the content

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312/ Id. Also, a method used by NRC to allow reactors to operate despite noncompliance with NRC regulations is the exemption process. The authority to grant exemptions from technical regulations has been delegated to the director, NRR, and redelegated to the director, DOR, with one exception (NRC Manual 0123, and Appendix 0123E). This exception deals with the ECCS for reactors issued operating licenses before 1975. All requests for these ECCS exemptions must be granted by the NRC commissioners (10 CFR 50.46(a)(2)(vi).

On April 27, 1978, TMI-1 received an exemption from 10 C.F.R. Part 50.46(a). This regulation requires all PWRS to have an ECCS system that is designed to compensate adequately for loss-of-coolant accidents of certain sizes. The TMI-1 exemption allowed the plant to rely on manual operation of the ECCS, if performed within 10 minutes of the beginning of an "event," to correct a deficiency in automatic operation (44 Federal Register 19080, March 30, 1979). (This was one of 92 exemptions granted between 1975 and September 1979. Only 10 requested exemptions were denied. See, Sept. 7, 1979, letter from Victor Stello, NRC, to Stanley M. Gorinson, President's Commission.)

On March 16, 1979, less than 2 weeks before the TMI-2 accident, DOR Director Stello granted a modification to the TMI-1 ECCS exemption. On March 30, 1979, the NRC published a public notice of this exemption, stating that "[c]ontinued reliance on prompt operator action... is undesirable and should be remedied as promptly as possible .... Met Ed committed to complete... [the] proposed modification at TMI-1 prior to operation following the 1980 refueling outage" (44 Federal Register 19080, March 30, 1979).

Stello approved the Met Ed request with the following justification: "[t]he public interest is served... [since] in the absence of an exemption, shutdown of the facility would be required. Loss of this large block of generating capacity could ... adversely affect the public" (44 Federal Register 19080, March 30, 1979). Stello explained that, since this was only a modification to an already approved ECCS exemption, no approval by NRC commissioners was required (Sept. 7, 1979, letter from Victor Stello, NRC, to Stanley M. Gorinson, President's Commission, item 3 response).

of operator procedures, or with control room design and other human-machine interface problems. These and other limitations discussed previously circumscribe and therefore operate to expedite the NRC's licensing design safety review.

1. Safety-Related Items

NRC's design review is limited to items labelled safety-related, safety grade, or systems important to safety.313/ Non-safety-related components are not reviewed to determine whether they will work as intended; they are not required to meet NRC design criteria; they need not be testable; they do not require redundancy; and finally, non-safety related components are not ordinarily subject to I&E inspection.314/ According to DSS Director Mattson, these categories are defined by historical rather than logical reasons. 315/ Moreover, it is the utility, not the NRC, that selects most components that are safety-related, and where disagreement between the utility and the NRC arises as to a particular component, it is resolved via negotiation, rather than by reference to an NRC-generated list of safety-related items.316/

According to the NBC's Lessons-Learned Task Force:

> In the licensing process, the specification of design basis events has resulted in the classification of systems into two types -- safety and nonsafety. The reliability and quality of safety systems are controlled through NRC requirements for their design, construction and operation. The NRC requirements for nonsafety systems are generally limited to assuring that they do not adversely affect the operation of safety systems.317/

However, whether there is an agreed upon understanding of safety-related at the NRC is open to question. NRC regulations use such broad terminology as:

313/ Novak deposition at 74; Bland and Reilly, "Quality Assurance and Reliability Assessment of Nuclear Power Plants," prepared for President's Commission at 29-30.

314/ Ross deposition at 41; Mattson deposition at 97; Jordan deposition at 50-52; Moseley deposition at 7; Thadani deposition at 51-52; see also, Haverkamp deposition at 33-34, 46.

315/ Mattson deposition at 97.

316/ Ross deposition at 100-101.

317/ TMI-2 Lessons-Learned Task Force Status Report and Short-Term Recommendations, NUREG-0578, July 1979, hereinafter cited as "TMI Lessons Learned Report," at 17.

> The principal design criteria established the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components important to safety; that is, structures, systems, and components that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public.318/

> The pertinent requirements of this appendix apply to all activities affecting the safety-related functions of those structures, systems, and components; these activities include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, operating, maintaining, repairing, refueling, and modifying.319/

Confusion as to the meaning of the terms is demonstrated by testimony from the former assistant director of the Division of Systems Safety and from a RSB design reviewer:

> QUESTION: What are the requirements or characteristics of a safety-related device besides redundancy?
>
> ANSWER: It varies because safety grade is not a well-defined term. You mentioned one, redundancy. It almost always included what is known as seismic class 1 which means it is designed to withstand the design earthquake for that facility. 320/

> ANSWER: I don't have an exact definition of safety-related that I could give you. I could say I will make an attempt.
>
> QUESTION: Please do.
>
> ANSWER: A safety-related component would be one that was necessary to mitigate the consequences of a transient or accident, that is, to prevent violation of safety limits. Or would be relied upon to prevent the release of radioactive material.
>
> QUESTION: Let me read from the first paragraph of your resume and ask you if this expresses the same definition or another definition of safety related. "The reactor systems branch is responsible for evaluating the capability of reactor safety systems needed for safe shut-down during normal and accident conditions, including the performance of emergency core systems."

318/ 10 CFR Part 50, Appendix A (emphasis supplied).

319/ 10 CFR Part 50, Appendix B (emphasis supplied).

320/ Ross deposition at 36.

ANSWER: Yes. Safe shut-down would be another aspect of what I was saying.321/

The PORV which stuck open during the TMI-2 accident was not a safety-related component. 322/ It was not safety-related because it had a block valve to isolate it from the primary system, and the block valve was not safety-related because it had a PORV in series with it.323/ According to the director of the Division of Systems Safety, had the PORV been deemed safety-related, more attention would likely have been paid to the generic implications of past problems with PORVs.324/ The valve also would have been subject to the NRC design criteria, redundancy, maintenance, testability, and inspection requirements. Control room design, instrumentation, in-core thermocouples and operator procedures also were not deemed safety-related.325/

2. Design Basis Analysis (DBA)

In a March 1975 memorandum, Stephen Hanauer, then technical advisor to NRC's executive director for operations, advised:

> The [Rasmussen] Study has pointed out a disparity between (a) our present "design basis" safety approach in which all potential accidents are either put into the design basis for complete mitigation or remain outside the design basis and have no safeguards compared to (b) the more realistic viewpoint of a spectrum of accidents each with probability and consequences of its own. Serious consideration should be given to modifying the present all-or-nothing approach in the light of reality.326/

321/ Newberry deposition at 49. For additional variations on the definition of safety-related, see, Seyfrit deposition at 42-43 (anything that contributes to a reduction in coolant inventory); Eisenhut deposition at 8-10 (barriers to radioactive fission products; primary pressure and containment boundaries; systems and components that mitigate accidents); Silver deposition at 117 (it is a "judgmental thing").

322/ Newberry deposition at 49; Jordan deposition at 51-52; see also, Grimes deposition at 6.

323/ Mattson deposition at 98; TMI Commission Hearings, Mattson testimony, Aug. 22, 1979, at 240.

324/ Mattson deposition at 98; TMI Commission Hearings, Mattson testimony, Aug. 22, 1979, at 239-240.

325/ See, Eisenhut deposition at 52; Denton deposition at 96; Silver deposition at 136-137; Moseley deposition at 146-150; Haverkamp deposition at 38-40; Washburn deposition at 68-69; Kennedy deposition at 51-52.

326/ Memorandum from Stephen H. Hanauer to Commissioner Gilinsky, "Technical Issues," March 13, 1975, at 2.

The NRC has postulated nine classes of accidents and occurrences.

No. of Class	Description
1	Trivial Incidents
2	Miscellaneous Small Releases Outside Containment
3	Radwaste Systems Failure
4	Events that Release Radioactivity into the Primary System
5	Events that Release Radioactivity into the Secondary System
6	Refueling Accidents Inside Containment
7	Accidents to Spent Fuel Outside Containment
8	Accident Initiation Events Considered in Design-Basis Evaluation in the Safety Analysis Report
9	Hypothetical Sequence of Failures More Severe than Class 8.327/

Class 9 events are not considered by the NRC staff in safety analysis to establish the performance requirements of engineered safety components and systems. Instead, NRC technical reviews employ a "design basis analysis" which excludes Class 9 occurrences on the assumption that there is a low probability they would occur:

> The occurrences in Class 9 involve sequences of postulated successive failures more severe than those postulated for the design basis for protective systems and engineered safety features. Their consequences could be severe. However, the probability of their occurrence is so small that their environmental risk is extremely low. Defense in depth (multiple physical barriers), quality assurance for design, manufacture, and operation, continued surveillance and testing, and conservative design are all applied to provide and maintain the required high degree of assurance that potential accidents in this class are, and will remain, sufficiently remote in probability that the environmental risk is extremely low.328/

327/ WASH-1250 at 5-13; proposed annex to 10 CFR Part 50, Appendix D, 36 Federal Register 22851 (Dec. 1, 1971). The annex has not been formally adopted by the NRC. See, memorandum from Roger J. Mattson to Guy H. Cunningham (Aug. 16, 1979), "Board Question Concerning Class 9 Accidents," at 1 and footnote 1.

328/ Proposed annex to Appendix D, 10 CFR Part 50, 36 Federal Register 22851 at 22852, (Dec. 1, 1971); WASH-1250 at 5-19.

According to the courts and the NRC staff a "breach of containment" or a "core melt" accident would fall into Class 9.329/ Analyses of accidents involving multiple failures of engineered systems, which are also considered to be Class 9 events, are not undertaken because "[i)t is clear that the assumption... can be carried to the point at which safety systems can no longer be shown by convervative calculation to cope with the postulated accident."330/

According to the AEC, analysis of such a Class 9 accident would require analysis of:

> ...a very large number of components including piping, pumps, valves, tanks, electric power components, and instrumentation and control equipment. Such factors as adequacy of design to cope with common-mode failures and the implications of inspection, maintenance and repair frequency would have to be factored into the system and component reliability estimates. Furthermore, because of the number of systems provided that affect safety and the course of accident sequences, extensive studies of the inter-relationship of these systems would also have to be made.331/

In addition to confining design basis analysis to serious events short of Class 9 events, NRC excludes consideration of lesser events from the design safety reviews. This is justified by a belief that analysis of a serious event *ipso facto* takes into account or "bounds" any lesser event of the same kind.332/ For example, the license review of the reactor coolant system design and the combustible gas control system require demonstrated capability to respond to a hypothetical LOCA involving a loss of reactor coolant, at a rate in excess of the capability of the reactor coolant makeup system, from breaks in the reactor coolant pressure boundary, including a break "equivalent in size to the double-ended rupture of the largest pipe in the reactor coolant system."333/

329/ *Carolina Environmental Study Group v. U.S.*, 510 F. 2d 796, 798, 799 (D.C. Cir. 1975); *Offshore Power Systems* (Floating Nuclear Power Plant) 8 NRC 194, 209 (August 1978); NRC staff response to board question No. 4 regarding the occurrence of a Class 9 accident at Three Mile Island, Dkt 50-272, Aug. 24, 1979, at 2.

330/ WASH-1250 at 5-19; Kennedy deposition at 22.

331/ WASH-1250 at 6-30.

332/ See, e.g., NRC Nuclear Energy Center Site Survey-1975, at 4-62; Denton deposition at 51.

333/ See, 10 CFR Subsections 50.44, 50.46 (c)(1), Appendix A (Definitions and Explanations), and criterion 46.

The assumption is that smaller breaks are well within the capability of the available coolant makeup systems and are not limiting.334/

As early as 1969, an AEC internal study group observed that for "the larger reactors, containing the worst accident considered credible does not ensure that all credible accidents would be contained," and recommended that safety reviews consider a spectrum of large accidents.335/

In September 1977, as discussed in Section IV.C(2), supra, ACRS consultant Carlyle Michelson prepared several reports and demonstrated that very small-break LOCAs were different than, and thus not "bounded" by, large-break LOCA analysis and could progressively degrade into serious events. 336/ In late 1977, the ACRS posed a number of questions to the Pebble Springs license applicant regarding time dependent effects of a relatively small primary coolant break on the pressurizer, steam generator, and reactor vessel, which "causes coolant to approach or even partly uncover fuel pins."337/ The reply provided by the applicant was unresponsive, yet no followup was done by RSB, in part because the ACRS inquiries went beyond the design basis analysis required by the regulations.338/

In May 1979, NRR issued a report which observed that the "TMI-2 accident indicates that the possible effects on core coolability for smaller breaks are not completely understood" and recommended that additional analyses be done of small-break LOCAs.339/

On Aug. 24, 1979, the NRC staff declared that TMI-2 was a Class 9 accident:

> [T]he Three Mile Island [Unit 2] accident involved a sequence of successive failures (i.e., small-break loss-of-coolant accident and failure of the emergency core cooling system) more severe than

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334/ "Staff Report on the Generic Assessment of Feedwater Transients in Pressurized Water Reactors Designed by the Babcock & Wilcox Company" (NUREG-0560, May 1979), at 8-13.

335/ "Report to the Atomic Energy Commission on the Reactor Licensing Program" (Internal Study Group, June 1969), at 21-22.

336/ Michelson deposition at 8-14.

337/ See, Appendix W, NUREG-0560 at 6.

338/ See, Ebersole deposition at 69-70; Novak deposition at 58.

339/ NUREG-0560, supra, at 8-13 and 8-14.

those postulated for the design basis of the plant. [Therefore,] the staff has concluded that the occurrence at Three Mile Island was a Class 9 accident. (emphasis added)340/

The TMI-2 accident has raised serious questions about the NRC's assumption that limited design basis analysis is sufficient because multiple-failure accidents are unlikely to occur and because small events are "bounded" by analysis of large events of the same kind:

> Many of the events that occurred were known to be possible, but were not previously judged to be sufficiently probable to require consideration in the design basis. Operator error, extensive core damage, and production of a large quantity of hydrogen from the reaction of zircalloy cladding and steam were foreseen as possible events, but were excluded from the design basis, since plant safety features are provided to prevent such .... A central issue that will be considered is whether to modify or extend the current design basis events or to depart from the concept. For example, analysis of design basis accidents could be modified to include multiple equipment failures and more explicit consideration of operator actions or inaction[s], rather than employing the conventional single-failure criteria.341/

3. Single Failure Analysis

"Single failure" analysis is the means by which analysis of multiple failure accidents is avoided. It is an essential ingredient of NRC's design basis analysis and serves to limit severely the scope of design review. "Single failure" is defined by the NRC as "an occurrence which results in the loss of capability of a component to perform its intended safety function." Multiple failures resulting from a single occurrence are considered to be single failure.342/

Thus, the staff's design safety review is based upon the assumption that a single system failure will not be compounded by other random failures. For example, having designed for the failure of a single component, such as loss of main feedwater, the utility would not be required to go

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340/ Matter of Public Service Electric & Gas Co. (Salem Nuclear Generating Station, Unit 1), Docket 50-272, "NRC Staff Response to Board Question, No. 4 Regarding the Occurrence of a Class 9 Accident at Three Mile Island," at 3.

341/ TMI Lessons-Learned Report, NUREG 0578, at 16-17.

342/ 10 CFR Part 50, Appendix A; see also, Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants LWR Edition" (Rev. 3, 1978) at 15-4; Kennedy deposition at 20. For a description of single failures which are multiple failures resulting from a single occurrence, see WASH-1400, "Reactor Safety Study," Appendix 10, Appendix A.

further in its Safety Analysis Report (SAR) and postulate that other parts of the system (e.g., auxiliary feedwater system) would fail to function.343/

The use of single-failure analysis at the licensing stage directly impacts upon NRC regulation of the facility after it has received its operating license. An example is provided by I&E's discounting of a concern raised by a Region I inspector about a transient at TMI-2 2 months after it received its operating license, and one year prior to the March 1979 accident. On March 29, 1978, the PORV failed open, causing a shutdown of the plant. The regional inspector requested review of the design approach (valve failing open on loss of control power). The design was determined by I&E to be acceptable in view of the TMI-2 FSAR:

> QUESTION: Do you recall the reason that it was concluded that PORV failing in the open position was an acceptable design feature of TMI-2?
>
> SEYFRIT ANSWER: ...The major one was that the high pressure safety injection system was sized to be able to provide water to the reactor at a rate greater than could be lost through the open'PORV. So that there was indeed a back-up system in the event of a failure. And based on the single failure criterion which has been used by the NRC traditionally, that would make it an acceptable design.
>
> QUESTION: In other words, the assumption would be that a single failure of the PORV would not result in core uncovery because no failure with respect to ECCS was built into the analysis?
>
> SEYFRIT ANSWER: That is correct.344/

Similar use of single-failure analysis in plant design has produced operator training programs that assume that systems will suffer "single" rather than multiple failures.345/

The TMI-2 accident was a multiple-failure accident -- main feedwater and auxiliary feedwater failures and a PORV failed open -- that was not planned for346/ and for which no operator procedures had been developed. The operator:

343/ Thadani deposition at 37; Silver deposition at 84-86.

344/ Seyfrit deposition at 62-63.

345/ Collins deposition at 104-105. See, "Operator Licensing and Training," Section VII of this report, infra.

346/ Ross deposition at 119; NUREG 0560, supra, at 8-12, 8-13, 8-14; but compare WASH-1400, "The Reactor Safety Study," Appendix II (October 1975), e.g., section 5.2 (Auxiliary Feedwater System), at 11-102, 11-106; section 5.6 (Emergency Coolant Injection System), at 11-129, 11-142.

> ...had no guidance whatsoever from the nuclear industry in this respect. He [had] to wing it. He [had] to kind of make up his own guide lines .347/

Operators were not trained to analyze and respond to events -- such as multiple-failure transients -- that were not specifically addressed in their training and operating procedures.348/

Nevertheless, NRC Chairman Hendrie testified that, notwithstanding the recognition that single-failure analysis "come[s] up short" in light of the TMI-2 accident, the 70 operating plants in the United States have been licensed pursuant to single-failure analysis, and plants now coming up for OL issuance have also been reviewed under the same system.349/

4. Human Factors

As early as 1975, it was recognized within the NRC that:

> Present designs do not make adequate provision for the limitations of people. Means must be found to improve the performance of the people on whom we depend and to improve the design of equipment so that it is less dependent on human performance.... The relative roles of human operation and automation (both with and without on-line computers) should be clarified.350/

Nevertheless, at the time of the TMI-2 accident, the limitation of the design review to single-failure analysis was still compounded by the NBC's exclusion of the human factor from systems analysis:

> QUESTION: ...Is there any office within the NRC that looks at the man-machine interface...?
>
> MATTSON ANSWER: No.
>
> * * *
>
> QUESTION: Why has it become the situation then that certain types of accidents are simply not anticipated or designed against today?

347/ Ross deposition at 128.

348/ Novak deposition at 70-72.

349/ Hendrie deposition at 41-45, 47-48. Commissioner Ahearne testified that as a result of the determination that TMI-2 was a Class 9 accident, the NRC will have to re-examine the issue of multiple failures. Ahearne deposition at 162-163.

350/ Memorandum from Steven Hanauer to Commissioner Gilinsky, "Technical Issues," March 13, 1975, at 2.

MATTSON ANSWER: ...[P]eople believed evidently in providing safety systems, well engineered, well designed, well analyzed safety systems, and the fault was they believed so much in the infallibility of those safety systems, they forgot about the people who could stand by and defeat them if they didn't have the right training.351/

NOVAK ANSWER: ...[W]e in the Systems Branch did not specifically look at the operator actions. It may now in hindsight be a weakness or a specialization by which the Branch did its work that it was not able to really put the operator in the systems review process.352/

NRC's inattention to the human factor in the licensing design review process repeatedly prevented it from learning important lessons that could have mitigated or prevented the March 1979 TMI-2 transient. For example, with respect to the Davis-Besse 1 transient of Sept. 24, 1977, described in Section VIA, infra:

QUESTION: Would it be accurate to say that as a result of the review of the Davis-Besse incident you were not aware of the operator action in that incident?

NOVAK ANSWER: No. We probably were aware of it. It was difficult for us to incorporate it in a sense into our review process.353/

With respect to the concern expressed in the Michelson report of January 1978:

QUESTION: Mr. Mattson, is there any possibility in your mind that someone with a technical background in the NRC reading that language would not have concluded that Mr. Michelson was expressing a concern about possible operator error based upon pressurizer level?

MATTSON ANSWER: ...[I]t may very well have been that the staff would have said that the ECCS if allowed to. do what it is designed to do, even accounting for single failure, would make this problem go away because there is no operator role.

QUESTION: But there clearly is an operator role.

MATTSON ANSWER: There clearly is. There clearly was 354/

351/ Mattson deposition at 28, 218.

352/ Novak deposition at 51.

353/ Id.; See also, Mattson deposition at 43-44.

354/ Mattson deposition at 43.

With respect to the Novak/Israel memorandum of Jan. 10, 1978, discussed in Section IV.C(2), supra:

> QUESTION: ...[W]ith respect to the final paragraph where there is this ... concern that procedures be reviewed to ensure adequate information to the operator, is what you are saying that that simply didn't catch your eye?
>
> NOVAK ANSWER: It didn't catch my eye, and if I were to probably suggest that we might have done it, at most it would have been part of the operating license review ... but that is speculating because we, as I must point out, we don't as a normal part of our review, we have not combined the review of procedures and design.355/

It is Commissioner Kennedy's understanding that:

> NRC's current philosophy regarding operating procedures at nuclear power plants embodies a general reluctance to formally review and approve such procedures because of potential liability considerations. As a result, our activities in this area have been comparatively limited.356/

Similarly, NRC ignored the human factor by failing to review control room design.357/ Prior to the TMI accident, it was noted that industry was largely inattentive to control room design.

> ...[I]t has now become evident that the U.S. nuclear power industry has traditionally ignored the importance of this science. In a number of studies, including the Rasmussen Report (WASH-1400), the design of controls, displays, and their arrangements on nuclear power plant control panels were criticized. Such arrangements were considered "as deviating from human engineering standards generally accepted in other industries."358/

Indeed, the NRC and the AEC have been aware of the problem for a number of years. In 1973, Stephen Hanauer, former chairman of the ACRS committee that reviewed TMI-2 in 1969, reported:

355/ Novak deposition at 37.

335/ Memorandum from Richard T. Kennedy to Lee V. Gossick, "Operating Procedures at Nuclear Power Plants," May 3, 1979.

357/ For a discussion of the TMI-2 control room, see, R. Eytchison, "Technical Staff Analysis Report on the Control Room," prepared for the President's Commission.

358/ Clark, Wilson, Human Factors Engineering and Nuclear Power: A Survey (1979), at 2.

> I do not believe that our present system of control room design is anywhere near optimized for safe reactor operation. For better or for worse, we have in this country accepted placing the reactor operator in an important position with regard to reactor safety. Not only do we rely upon him to manage the entire operation, but we have assigned him specific safety-related duties to perform....
>
> I suggest to you that a substantial fraction of the control rooms now being <u>constructed bear far too great a resemblance to the one I built in the early 1950's. I know for a fact that the technology has advanced. I do not believe that most of the nuclear power industry has advanced with it....</u> 359/

The importance of control room design to the operator's ability to operate the plant safely was also expressly recognized by the nuclear industry:

> Nuclear power plant control rooms are much larger than those used for aerospace applications. The majority of operators prefer smaller control rooms that are more easily manageable in terms of visual span and the distances to be traversed. Furthermore, the operators prefer to have all relevant controls and instruments within their primary control room area rather than having to divert their attention to back racks or remote areas of the control room...
>
> ...[W]e have reviewed control board designs as observed at five nuclear power plant control rooms. The major problems observed were: (1) excessively large control boards that require too great a visual and control span for the operator, (2) mirror-imaged control boards that grossly violate human factors principles of transfer of training and preclude consistency of operator response patterns, and (3) a general lack of clearly demarcated functional groups of panel elements into major systems and subsystems....

359/ Stephen Hanauer, "Control Room Standardization: A Safety Goal," (Nov. 15, 1973), at 3, 7; (emphasis supplied). See also, "Staff Report on the Generic Assessment of Feedwater Transients in Pressurized Water Reactors Designed by the Babcock & Wilcox Company," NUREG-0560, (May 1979), at 4-4 to 4-5; Budnitz deposition (Aug. 1, 1979) at 65-67.

> The present control board designs require the operator to assimilate too many discrete and widely scattered bits of information. The relations among items of displayed information and associated control options are not clearly portrayed by the panels 360/

Moreover, "[w]hen an emergency occurs, the excessively large number of indicators that are illuminated, in concert with blaring horns, startle the operator and overload his sensory mechanisms, rather than shed light on the problem at hand."361/ Although this reads like a description of what occurred at.TMI-2 on March 28, 1979, it was written almost 2-1/2 years before the accident. 362/ Presently, the deputy director of the NRC's DOR is unaware of an pressurized water reactor plant in the United States with a priority system of alarms.363/

The failure to take the human factor into account during plant licensing played a role in the TMI-2 accident. 364/ For example, it has been suggested that the TMI-2 operator would have discovered that the PORV was stuck open, despite failure of the PORV position indicator, by observing the quench tank temperature and pressure indications.365/ However, the quench tank indicators at TMI-2 are located on the back of the control panel, and therefore are not readily available to the operator. 366/ Positioning these indicators on the back of the control panel is not a violation of any NRC requirement367/ because NRC has no specific requirements at all regarding control room layout368/ and does not review control room design.369/ This is because control room design

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360/ Lockheed Missiles & Space Co., Human Factors Review of Nuclear Power Plant Control Room Design (prepared for EPRI, March 1977), at 4-29, 5-48, 5-53, hereinafter cited as "EPRI Final Report."

361/ Id. at 1-18.

362/ Compare Gossick deposition at 53-54; Eisenhut deposition at 117.

363/ Eisenhut deposition at 117.

364/ NUREG 0560, supra, at 8-11 and 8-12.

365/ Boger deposition at 39-41.

366/ Haverkamp deposition at 44; Boger deposition at 14-15.

367/ Haverkamp deposition at 44-45.

368/ Ashe deposition at 65.

369/ Mattson deposition at 211-212; Ashe deposition at 65; Boyd deposition at 63-64.

was not considered safety-related. 370/ Yet, a 1977 EPRI report noted that the "back panel" problem creates serious difficulties for the operator; their attention to primary panels must be diverted during both normal and emergency operation.371/

The NRC has also repeatedly failed to implement a proposed requirement for control room instrumentation to aid in accident diagnosis and control. Regulatory Guide 1.97, entitled "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," first issued for comment in Decemer 1975, would require instrumentation adequate to provide the operator with necessary accident information.372/ The matter was further recommended for resolution by the ACRS in January 1977 in connection with the licensing process for the Davis-Besse plant.373/

As of Dec. 29, 1978, the regulatory guide had still not been implemented:

> [I]ssuance of the guide for comment generated opposition as reflected in the letter, dated June 13, 1978, from the Atomic Industrial Forum (AIF). On Nov. 9, 1978, the staff met with an ad hoc committee of the AIF. As a result of that meeting, the staff has agreed to revise its action plan and work directly with the ad hoc committee of the AIF. The staff is preparing a response to the AIF letter, dated June 13, 1978, and will be revising its task action plan and schedule.374/

In a report transmitted to senior NRC staff members March 28, 1979, the day of the TMI-2 accident, the director of NRC's Division of Site Safety and Environmental Analysis cautioned that the "operator must not be placed in a position where all his relevant instrumentation is off-scale."375/ Yet this was precisely the case during the TAI-2 accident when the operators, utilizing computer printouts from core thermocouples that only read to a maximum operating temperature of 700°F, were unable to determine the core temperatures reached during the

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370/ Ahearne deposition at 172; Kennedy deposition at 51-52.

371/ EPRI Summary Report, supra, at 1-4.

372/ Memorandum from De Young to Mattson, Boyd, Stello, and Case, March 28, 1979, enclosed report at 1.

373/ Memorandum from Denton to Ahearne, Dec. 20, 1978, at 6.

374/ Id.; Minogue deposition at 67-69. The AIF June 13, 1978, letter was from John E. Ward, chairman, AIF Committee on Reactor Licensing and Safety to Edson G. Case, acting director, NRR.

375/ Memorandum from De Young to Mattson, Boyd, Stello, and Case, March 28, 1979, enclosed report at 3.

initial hours of the accident.376/ According to several senior NRC staff members and as discussed in Section VIII.B, infra, of this report, the absence of such temperature information prevented both the NRC and Met Ed from realizing the potentially disasterous consequences of attempting to depressurize the primary system to go on decay heat removal approximately 7-1/2 hours into the accident.377/ Attempted depressurization was abandoned after a time, but further core uncovery and melting could have been the result if Met Ed had persisted.378/

Since the TMI-2 accident, the NRC staff has decided to expedite revision of Regulatory Guide 1.97.379/

The NRC also failed to address the impact on human factors of the B&W-designed OTSG. In addition to providing steam to run the turbine, the steam generator serves an important safety role in disposing of decay heat.380/ Upon a loss of feedwater, the B&W OTSG boils dry many times faster than the recirculation steam generator used in the Westinghouse design, and has a direct impact on the amount of time that the operator has to respond to a transient.381/

As to the impact of the OTSG on the ability of the operator to respond to a transient:

> <u>ROSS ANSWER:</u> ...There is a direct correlation between the time to do nothing and when you should be doing something or to undo something you should not have done. The Westinghouse system is more forgiving. You can have a sense of nonfeasance or malfeasance and recover. So the B&W would be less forgiving.
>
> <u>QUESTION:</u> ...[W]here misleading information is provided to the operator as to core coolant level based on pressurizer level and he terminates HPI based on the determination, the Westinghouse [design] would allow him a greater amount of time to correct that error?

376/ Moseley deposition at 117-118; Eisenhut deposition at 49-52.

377/ Moseley deposition at 115-116; Eisenhut deposition at 47-49.

378/ Moseley deposition at 115-116; Eisenhut deposition at 53-54.

379/ TMI Lessons-Learned Report, NUREG-0578, at 11.

380/ Michelson deposition at 9-10.

381/ Ross deposition at 30-32, Thadani deposition at 28, and Exhibit 2, at 4-6; Denton deposition at 33-34; Eisenhut deposition at 76-79; Engle deposition at 13. The rapid boil-out of the B&W steam generator design has been attributed to two features: a smaller liquid inventory than other designs, and the absence of anticipatory scram. See, Mattson deposition at 228-229; Thadani deposition at 25, 31-32; Moseley deposition at 37-39.

ROSS ANSWER: Yes, but it is more than that. The Westinghouse design being more sluggish would not have reacted that way or at least not that quickly, so there would be a double benefit.382/

Although the impact of the OTSG's sensitivity on the time the operator has to deal with transients was known prior to the TMI accident383/, it was not recognized by the NRC as posing a safety concern:

QUESTION: Would you conclude a rapid reaction of the B&W plant and shortcuts on the OTSG (once through steam generator) is a safety-related matter or safety concern?

ROSS ANSWER: Yes, it is.

QUESTION: Was that a safety concern which was recognized prior to TMI-2?

ROSS ANSWER: I don't think adequately, no.384/

Harold Denton, the director of the NRC's Office of Nuclear Reactor Regulation, concluded after TMI-2 that this design posed "an unacceptable risk" and explained the NRC's prior oversight as follows:

> I think what had gone on Westinghouse plants had been approved who was number one for a long time, [C]ombustion [E]ngineering had designed steamwater generators with the same inventory scramming signals and along comes B&W with the once-through steam generator design and it sort of fell within the broad envelope of review.385/

NRC's deputy director of Operating Reactors stated that, from a design perspective, feedwater transients are more safety-related in OTSGs because they lead more rapidly to high heat and pressures, and thus to greater numbers of challenges to the PORV, than in other steam generator designs.386/

382/ Ross deposition at 31-32, as corrected by errata sheet; Thadani deposition at 36-37.

383/ Mattson deposition at 221-222.

384/ Ross deposition at 32; see also, Moseley deposition at 38-42.

385/ Denton deposition at 33.

386/ Eisenhut deposition at 76-82. See also, Denton deposition at 36-37; Thadani deposition at 31. Following the TMI accident, NRC has provided a partial solution by requiring anticipatory scram on B&W reactors. See, I&E Bulletin 79-05B, at 2, para. 5. The advantages of the OTSG over the RSG include greater efficiency and lower cost. See, Eisenhut deposition at 78-82; Mattson deposition at 224-225; Thadani deposition at 44-46.

5. Failure to Evaluate Operating Data in the Design Safety Review

As described in the introduction to this report, the licensing design review is also circumscribed by the limited extent to which recurring past failures of components, even safety-related components, are taken into account. In 1975, an NRC technical advisor pointed out that:

> The operating plants are one of our chief sources of information but we do not know whether the rate of abnormal occurrences now being experienced is a satisfactory one or not. We do know that nuclear unit availabilities and capacities are not satisfactory. We need to find out whether safety system availability is satisfactory and to improve whatever aspects of reliability need improving.387/

The GAO pointed out in a 1978 report that "the commission does not adequately analyze operating experience data or evaluate the data's impact on the licensing process."388/

Scott Newberry is a review engineer assigned the task of handling the LERs routed to DSS' Reactor Systems Branch. 389/ At the time of the TMI-2 accident, his procedure involved looking at current LERs that crossed his desk to determine if any were pertinent to a specific, presently ongoing design review and to route any such LER to the engineer doing that review. 390/ Current LERs containing general information about component failures were routed to all RSB engineers weekly.391/ A lot of LERs were simply thrown away.392/ The procedure described by Newberry contains no provision for systematic tracking of LERs over time to identify generic issues. Nor can the Division of Systems Safety in NRR rely upon I&E to identify generic design issues based on recurring failures, because I&E also has no formal mechanism for reviewing past operational experience at plants. 393/ Mattson put the deficiency into context, with respect to the PORV, as follows:

387/ Memorandum from Stephen H. Hanauer to Commissioner Gilinsky, "Technical Issues," March 13, 1975, at 3.

388/ GAO Report EMD-78-29 at ii. See also, Boyd deposition at 91-92; Grimes deposition at 76-77; Mattson deposition at 144; Minogue deposition at 75-76; Stello deposition at 12-16.

389/ Newberry deposition at 40.

390/ Id.

391/ Id. at 40-41.

392/ Id. at 41.

393/ Seyfrit deposition at 73-74. I&E's handling of LERs is discussed in greater detail in Section VI.C of this report, infra.

> The staff had never reviewed the integrated control system, the PORV, or the operating history with bad PORV performance, and had never systematically put all those things together, hadn't studied them individually, let alone put them together systematically.394/

6. Backfitting 395/

One NRC effort to deal with safety issues learned from experience over time is the Standard Review Plan.

The SRP, first implemented in September 1975,

> ...was a codification of existing review requirements [and]... was generally felt to be somewhat of an advancement of regulatory requirements. That is, there were more regulatory requirements, more sophisticated ...than had ever been issued before, and more details of how the Commission's regulations should be implemented. ...It says what the [review] requirements are ... [and] how [to] review to ascertain that they have been met, and it states the findings, and then it gives some .reference documents that if you research them, all you would get is a feel for the reason that the requirement was there .... [Its purpose was to achieve] some uniformity and consistency in the licensing requirements 396/

The SRP essentially "reflects the NRC's official position on what safety features belong in a nuclear reactor."397/

However, the NRC chose not to apply the SRP to any plant which received its CP prior to the time the SRP was issued. 398/ This decision was an across-the-board choice by the NRC "on the basis of formal action

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394/ Mattson deposition at 229-230.

395/ "The [c]ommission may, in accordance with the procedures specified in this chapter, require the backfitting of a facility if it finds that such action will provide substantial, additional protection which is required for the public health and safety or the common defense and security. As used in this section, 'backfitting' of a production or utilization facility means the addition, elimination or modification of structures, systems or components of the facility after the construction permit has been issued" (10 CFR Sec. 50.109(a)).

396/ Mattson deposition at 14, 15, 25; TMI Commission hearings, Mattson testimony, June 1, 1979, at 49.

397/ TMI Commission hearings, Mattson testimony, Aug. 22, 1979, at 223.

398/ Mattson deposition at 13-18.

on the plants rather than on the basis of [the actual] stage of construction" of the particular plant.399/ Thus, plants such as TMI-2 were "grandfathered" from the SRP even though they had not received their operating license and were still under review.400/ This decision allowed plants with CPs to obtain OLs and go critical without satisfying safety criteria that has been expressly recognized by the NRC staff. For example, it took the TMI-2 accident to demonstrate that TMI-2's containment isolation actuation by a single parameter -- containment pressure -- was insufficient and required correction,401/ even though the staff had years before recognized and required diverse containment isolation actuation.402/

The decision not to backfit the SRP requirements to plants which had CPs as of September 1975 was based on a desire to avoid undue burden on licensees:403/

> [I]t would be expensive and a judgment [was made] that a good job had been done on safety on those old plants.404/

The decision was made despite the fact that:

399/ TMI Commission hearings, Mattson testimony, Aug. 22, 1979, at 223.

400/ Mattson depositon at 14-17. Plants already with CPs as of September 1975, even if little actual construction had occurred, were exempted, across-the-board, from the SRP. Plants without CPs could deviate from the SRP, if the NRC license reviewer (not the applicant) documented and rationalized the deviation. Mattson depositon at 16, 23. In 1979, for the first time, the burden of justifying deviations was placed upon the applicant. See Mattson deposition at 22-23; see also, "Procedure for Documentation of Deviations from the Standard Review Plan" (Jan. 31, 1977), at 6, and Enclosure 2, "Implemention Program." NRC does have a program underway to review the eleven oldest plants for possible backfitting of the SRP. See, e.g., Seyfrit deposition at 71-72.

401/ Mattson deposition at 24; see also Denton deposition at 159.

402/ Mattson deposition at 12-13; TMI Commission hearings, Mattson testimony, Aug. 22, 1979, at 224. A similar example concerns the iodine filters at TMI-2, which permitted a greater than expected amount of Iodine-131 to escape during the accident, and which did not conform to the requirements of Regulatory Guide, 1.52, Rev. 1 July 1976. This Regulatory Guide came into effect a year before TMI-2 purchased the charcoal in its filters. However, the new requirement was not "ratcheted" onto TMI-2. See Bland, technical staff analysis report on "Iodine Filter Performance," prepared for the President's Commission.

403/ Mattson deposition at 21-22, 26-27.

404/ Id. at 21.

> in the years after 1975 ... [it was determined] that there has been significant variability plant to plant, case by case in the licensing review prior to issuance of the Standard Review Plan ... [This was] ... bad news [since] there were plants that had systems designs that weren't as good as some other plants.405/

The decision not to backfit the SRP to plants during the licensing stage impacts upon subsequent NRC regulation of such plants. I&E reviews plants with an eye to the FSAR, not the SRP.406/ Thus if a requirement is not in the FSAR, I&E will generally ignore it.407/

A post-TMI example of NRC's failure to backfit is Regulatory Guide 1.101, which requires licensees to develop plant, site, and general emergency plans. This regulatory guide, dated March 1977, is applied only to new operating license applicants. 408/ Older nuclear plants come under the less specific and less stringent provisions of 10 CFR 50 Appendix E.409/ As of Aug. 2, 1979, of the 48 sites with currently operating reactors, only four have plants with plans that the NRC staff considers to be in compliance with the regulatory guide, and the NRC has no program to bring the other sites' emergency plans into compliance.410/

NRR Director Denton, explained to this Commission that the regulatory guide was not backfitted due to "the manpower restraints" of the NRC that gave the Regulatory Guide a "low priority for backfitting."411/ However, it is the utility that develops the emergency plans, not the NRC; NRC merely reviews them.412/

On May 14, 1979, NRC Chairman Hendrie, in testimony before the Environment, Energy, and Natural Resources Subcommittee of the House Committee on Government Operations, explained the NRC's views on backfitting Regulatory Guide 1.101:

405/ Id. at 15.

406/ Seyfrit deposition at 70-72.

407/ Id. at 68-69, 71-72.

408/ House Report 96-413, at 18; Aug. 4, 1975, letter from Robert Minogue to E. Case, "Proposed Regulatory Guide 1.101, Emergency Planning for Nuclear Power Plants" and enclosure 1 (Working Paper 'D', June 1975).

409/ House Report 96-413, at 18.

410/ Id. at 19.

411/ TMI Commission hearings, Denton testimony, Aug. 23, 1979, at 19.

412/ Id. at 20; Regulatory Guide 1.101.

> What you do is to take a look at the operating plants and decide whether it is such a critical matter that they have to shut down now and implement. The judgment has been on emergency plans, no, it is not that sort of situation .... We cannot rebuild the industry every morning because last night at 5 o'clock you found a better way to write down a description of a safety feature.413/

However, as the Report by the House Committee on Government Operations observed, it is difficult to classify the implementation or upgrading of emergency plans as a cost burden on utilities:

> Upgrading an emergency plan can hardly be considered expensive, at least in comparison to safety changes involving redesign or replacement of major plant equipment, and it certainly cannot in any way be equated with "rebuilding" the industry.... In fact, the low cost and minimal burden on the regulated industry entailed in imposing a new emergency planning requirement make it difficult to imagine a better case for [backfitting].414/

Another post-TMI issue that highlights problems arising from NRC's reluctance to backfit current safety requirements involves the treatment and removal of radioactive liquid wastes produced by the TMI-2 accident.

Removal of the radioactive wastes415/ involves three steps: (1) decontamination and removal of some 387,000 gallons of contaminated water from the auxiliary building; (2) decontamination and removal of some 715,000 gallons of contaminated water from the containment building and the reactor coolant system; and (3) removal of the core.416/ The utility has the responsibility of devising, financing, and accomplishing

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413/ U.S. House of Representatives, Subcommittee on Energy, Natural Resources, and the Environment, Before the Committee on Government Operations, Oversight Hearings on Nuclear Regulation, May 14, 1979, at 573-574. See also, TMI Commission hearings, Denton testimony, Aug. 23, 1979, at 19-20.

414/ House Report 96-413, at 20. The NRC staff now has plans to upgrade emergency plans to Reg. Guide 1.101 at operating plants and near term OLs by mid-1980 for the former, and prior to OL issuance for the latter. See, memorandum to NRC commissioners from Harold Denton, SECY-79-450 (July 23, 1979), Enclosure 1, at 1.

415/ The important issues of how radioactive wastes are ultimately disposed of, and the safety implications of disposal, are beyond the scope of this report.

416/ In the Matter of Metropolitan Edison Company, et al., (Three Mile Island Nuclear Station, Unit 2), NRC Docket No. 50-320, Memorandum and Order of Oct. 16, 1979, at 2; R. Smith exhibit 9, at 3.

these steps.417/ Met Ed's approach to item one, the handling of the 387,000 gallons of auxiliary building wastes, is well defined. Met Ed proposes to "dewater" the wastes, and then ship them in the form of resin sludge, to a burial site at Hanford, Wash. It is for NRC to decide whether it will permit the wastes to be shipped in this semi-liquid form or require that the wastes be completely solidified for shipment, the latter being safer, but more time consuming and costly.418/

NRC's Division of Waste Management (DWM) is responsible for ensuring that radioactive wastes are safely transported to burial grounds and safely buried. 419/ In view of these responsibilities, DWM believes that the decision, regarding which waste form NRC will approve, is within its province. 420/ DWM has taken the position that NRC should require complete solidification of the wastes. 421/ DWM points to a history of corrosion of transport containers and radiation leakages where wastes are shipped in semi-liquid forms.422/ This history includes the June 1979 arrival at the Beatty burial site in Nevada of leaking containers from the Palisades reactor, and the governor's refusal to allow the containers to be buried in Nevada, 423/ and an August 1979 study of shipments of radioactive wastes to the Chem-Nuclear Burial Facility in South Carolina.424/

The study discloses a high number of leakages of semi-liquid wastes and no leakages from completely solidified wastes. 425/ DWM points out that there would be upwards of 200 truck loads of radioactive waste from

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417/ R. Smith depositor at 13-14, 30, 38.

418/ Id. at 34, 38; Dircks depositon at 8-11.

419/ Dircks depositon at 5; R. Smith depositon at 49.

420/ Dircks deposition at 5.

421/ Id. at 6-7.

422/ R. Smith deposition at 17-18.

423/ Id. at 20-21.

424/ Id., exhibit 2.

425/ R. Smith deposition, exhibit 2; the study shows that certain leaking shipments under went solidification via a urea-formaldehyde process, which actually produces a semi-liquid waste. See R. Smith deposition at 24-25, 36.

the auxiliary building alone, which would be trucked through 11-17 states over the next year to the Hanford site:

> What we would like to do is to see that waste solidified into some form that would not be movable if [there] were an accident on the road, and not contain any liquid in the disposal of that waste in a low-level waste burial ground.426/

> [DWM maintains that the primary function of NRC is to assure] that the licensee operates the reactor safely... the primary mission of the NRC is to protect public health and safety, and... that involves transportation of [radioactive] waste.... 427/

"Solid form, we feel would enhance transportation safety." 428/ For further support, DWM points to NRR's Effluent Treatment Systems Branch position paper, ETSB-11-3, Nov. 24, 1975. The branch position provides that reactors should have the capability to solidify radioactive wastes.429/ The SRP applies ETSB-11-3 to all new reactors. Although TMI-2 received its construction permit prior to the effective date of the SRP, DWM maintains that the EPICOR-II waste treatment facility, which was constructed at TMI-2 after the accident, is itself a new facility to which ETSB-11-3 should apply,430/ and that EPICOR-II should be modified to provide for solidified rather than semi-liquid wastes.431/

On the other side of the issue is NRR, which issued the ETSB-11-3 branch position in the first place. NRR maintains that the decision as to which form the TMI-2 waste will take is solely within its jurisdiction, not that of DWM, because NRR is responsible for licensing the particular waste treatment facility chosen by the utility.432/ DWM was not invited to attend two NRR meetings on the issue at the site, one attended by NRC Chairman Hendrie. 433/ It is NRR's position that TMI-2 should not be treated differently from other reactors,434/ and that ETSB-11-3 should

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426/ Dircks deposition at 6-7; R. Smith deposition at 49.

427/ R. Smith deposition at 49.

428/ Id. at 34.

429/ Id. at 57, 59.

430/ Id. at 34.

431/ Id. at 11, 58-59.

432/ Dircks deposition at 5-6.

433/ Id. at 13; R. Smith deposition at 46.

434/ R. Smith deposition at 35.

not be backfitted to TMI-2 wastes because TMI-2 received its construction permit prior to promulgation of the SRP.435/ As a result, the EPICOR-II system installed at TMI-2 after the accident lacks the capacity to produce solidified wastes, 436/ and "[t]he current position of NRR is that the resins will not be solidified. 437/ NRR maintains that the wastes are dry enough without solidification;438/ solidification would delay removal of the wastes from the TMI auxiliary building;439/ and, as compared with the additional costs of modifying EPICOR-II and solidifying the wastes, the safety benefits are "not easy to identify."440/

At a meeting held on Aug. 2, 1979, DWM and NRR presented their respective positions to Chairman Hendrie and Commissioner Ahearne. Chairman Hendrie stated:

> Overall, I have concluded that it [the present EPICOR-II system] looks like a reasonable system. I am concerned about the extended time before one could begin to process into the solid form.441/

435/ Id. at 10, 34-35, 58.

436/ Id. at 11.

437/ Id. at 46.

438/ Vollmer deposition at 44-46.

439/ Dircks deposition at 10-11. Contaminated waste water at TMI-2 is leaking into the auxiliary building at a rate of about 800-1,000 gallons per day. Based on calculations made in an NRC staff report, dated Sept. 30, 1979, a 30-day margin exists (from Sept. 29, 1979) until the auxiliary building tanks are filled. The current options for accomodating this leakage are:

- the prompt use of EPICOR-II to process the water so it can be placed in available waste removal tanks;
- the transfer of contaminated water into the TMI-1 tanks; and
- construction of new tanks on-site for the storage of highly contaminated liquids.

According to the Nuclear Regulatory Commission's staff report, a decision must be made by Oct. 29, 1979, in order to properly contain this radioactive waste. (Letter to Chairman Gary Hart, Subcommittee on Nuclear Regulation, from Commissioner Kennedy, NRC, Oct. 1, 1979.)

440/ Vollmer deposition at 47; R. Smith deposition at 35.

441/ Transcript, NRC Public Meeting, briefing on resins from EPICOR-II, Aug. 2, 1979, at 26.

DWM maintains that there is "no safety advantage whatsoever" in shipment of the wastes in simi-liquid form.442/ As Dale Smith put it:

> ...superimposed over all of that is kind of a nonscientific, nontechnical awareness that any incident, whether [or not] you technically view TMI waste as being any different than anybody else's, the public perception is something entirely different. The public reaction and the political consequences [of] what we feel is an almost indefensible position that NRC would be in if there were to be any kind of shipping incident or any kind of incident at the burial site that could have been prevented or at least minimized by solidifying the waste, that if a truck were to tip over and lose any contents, as low as that probability might be, or if the packages were unloaded at Hanford and found to have water and this was brought to the governor's attention and to the press's attention. And the obvious question that would be asked of NRC is wasn't there something you could have done to have prevented this? The obvious answer is yes.443/

On Oct. 16, 1979, the NRC commissioners issued a Memorandum and Order in connection with TMI-2 that authorizes the prompt activation of the EPICOR-II system to decontaminate the intermediate-level waste water in the auxiliary building.444/ At the same time, the NRC commissioners addressed the solidification issue:

> It is the [c]ommission's view that solidification of the EPICOR-II radioactive waste products... .prior to offsite shipment will contribute to improved safety during transportation and to the ease of final disposal. Accordingly, the Commission concludes that the licensee should be directed to construct expeditiously the necessary facilities for solidification and to store EPICOR-II wastes at TMI-2 until the resins have been properly solidified [footnote omitted]. There should be no shipment of non-solidified wastes offsite unless necessary to allow waste water decontamination to continue or unless otherwise required to protect public health and safety.445/

442/ R. Smith deposition at 49.

443/ Id. at 35-36.

444/ In the Matter of Metropolitan Edison Company, et al., (Three Mile Island Nuclear Station, Unit 2), NRC Docket No. 50-320, Memorandum and Order of Oct. 16, 1979, at 6, 14. This decision does not address the decontamination of the larger volume of high-level waste water in the containment building and the reactor coolant system. Id. at 2.

445/ Id. at 8-9.

E. INTERVENORS

> No elite group of experts, no matter how broadly constituted, has the ability to make an objective and valid determination with respect to what benefits people want and what risks people are willing to assume in order to have the benefits.446/

As previously noted, members of the public, state, and federal agencies may participate in the licensing process by intervening in hearings at the stage, and may seek an ASLB hearing at the stage in order to raise as yet unadjudicated safety issues.447/

There are those who have contended that intervenors unnecessarily delay the licensing process. 448/ However, the value of intervenors in the licensing process has been addressed on a number of occasions by members:

> ...[D]elay in the issuance of an operating license attributable to an intervenor's ability to present to a licensing board legitimate contentions based on serious safety problems uncovered by the staff would establish not that the licensing system is being frustrated, but that it is working properly. Any delay in such a situation would be fairly attributable not to the intervenors but to the non-readiness of the facility for operation. Delay in the issuance of the license is entirely appropriate--indeed, mandated--in that circumstance.449/

> ... [A]s the Appeal Board in the River Bend proceeding recently put it in responding to a disparagement by an applicant of the values of interventions, "[p]ublic participation in licensing proceedings not only can provide valuable assistance to the adjudicatory process,

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446/ H. Green, "Risk-Benefit-Calculus in Safety Determinations," 43 George Washington L. Rev. at 792 (1975), quoted in Rolph, supra, at 101.

447/ No in-depth investigation of the ASLBs and ASLABs has been done, due to time and resource constraints. As to the breadth of issues that may be raised during the ASLB and ASLAB proceedings, see Matter of Consolidated Edison Company of New York (Indian Point Nuclear Generating Unit 3), CL1-74-28, Docket 50-286, Memorandum and Order dated July 16, 1974; Jan. 5, 1979, letter from James L. Kelly, acting general counsel, to NRC commissioners, "Modification of Rules Governing Board Review of Uncontested Issues." But see, Jensch, "Hearing Procedures," supra; TMI Commission Hearings, Creswell Testimony, Aug. 22, 1979, at 88-92.

448/ See, Rolph, supra, at 123.

449/ Vermont Yankee Nuclear Power Corp, ALAB-124, 6 AEC 358, 365, 1973.

but on frequent occasions demonstratably has done so." (Matter of Gulf States Utilities Company, River Bend Station Units 1 and 2 (March 12, 1979) ALAB-183, slip opinion at 11-17.) In elaboration, that Board pointed out that "many of the substantial safety and environmental issues which have received the scrutiny of licensing boards and appeal boards were raised in the first issuance by an intervenor(ibid, Slip opinion at 12)."450/

Three studies of licensing delays, conducted in the early 1970's, evidenced that most delays were caused not by intervenors, but by the applicants. Of 66 instances of delay reviewed by one study, only one was attributed to the licensing process; the rest were caused by the applicants -- incomplete applications, slow responses to questions, site and design changes, construction exemption, unusual site or safety features, construction defects and construction delays. 451/ The second study showed that of 75 plants, only nine were delayed by licensing interventions and nine were delayed by a combination of intervenors and other problems (technical, labor, unavailability of equipment, etc.).452/ A 1973 Federal Power Commission (FPC) study of 28 delayed plants showed that intervention contributed to delay in only four cases, and accounted for only 3.5 percent of the total time of the delays for the plants studied. 453/ One commentator has observed that licensing delays were attributable to a number of causes:

> Plants were growing larger and more complex. Staff workloads were increasing. Applicants themselves caused delays by filing incomplete applications and not allowing for clearly predictable application procedures. And although intervenors may not have been the direct cause of much delay, they, no doubt, made the regulatory staff considerably more cautious and conservative.454/

Appearing before the President's Commission on Aug. 23, 1979, Anthony Roisman, staff attorney of the Natural Resources Defense Council (NRDC), an intervenor group, described the difficulties of intervenors as follows:

450/ Statement of Alan J. Rosenthal (ASLAB chairman) before the JCAE, April 24, 1974, at 2-3.

451/ "Hearings on Licensing Procedure and Related Legislation," JCAE at 565-571 (June-July, 1971), cited in Rolph, supra at 123-124.

452/ Rolph, supra at 123.

453/ Id. at 124.

454/ Id. but see footnote 5, supra.

- The NRC staff is not neutral at the ASLB hearings, but tends to support the applicants.455/

- Intervenors have difficulty obtaining the necessary documents and technical expertise, due in part to inadequate funding, and;

- The procedure of evaluating in detail the safety concerns relating to a particular application at the OL stage, after great amounts of money have been invested in the plant after issuance of the CP, greatly biases the process toward granting the OL.456/ Mr. Roisman claims that as a result, with TMI-2, "[n]ot only were specific problems now recognized as real [were] rejected as unsubstantiated challenges to the plant..."

During the license proceeding for TMI-2, two intervenors presented 13 contentions claiming various design and construction inadequacies.458/

Two claims dealt with inadequate radiation monitors and evacuation plans.459/

Ironically, the issue of intervenor funding has come to the fore in the context of NRC's consideration of post-TMI-2 accident restart procedures for TMI-1. At the end of July 1979, NRC general counsel Leonard Bickwit concluded "that the Commission's authority to fund intervenors remains reasonably firm."

> NRC's existing ability to fund intervenors stems from a December 1976 letter from the Comptroller General that sets down two basic standards for agency financing of intervenor costs -- one is whether the proposed participation is considered potentially helping in the agency decisionmaking process; and, if so, whether the would-be participant needs financial assistance to participate.460/

455/ Roisman prepared statement at 14-15.

456/ TMI Commission Hearings, Roisman Testimony, Aug. 23, 1979, at 243, 251, 253, 279-280; prepared statement at 3-4.

457/ Not used.

458/ See, Petition for Intervention by Citizens for a Safe Environment, of Harrisburg, Pa., and the York Committee for a Safe Environment, of York, Pa., June 18, 1974.

459/ See, "Report of the Office of Chief Counsel on Emergency Preparedness and Response," prepared for the President's Commission, for a discussion of the emergency planning issues raised by the TMI-2 intervenor.

460/ Nucleonics Week, Vol. 20, No. 34, Aug. 23, 1979, at 5.

NRC Commissioner Bradford proposed that the NRC consider intervenor funding for the restart proceedings, but other NRC commissioners raised questions about NRC authority to do so.461/ The issue, which has implications for intervenors beyond the TMI-1 situation, is

> ...whether NRC continues to have congressional support for intervenor funding. Sources cite a sentence in NRC's [1979] appropriations-bill report, specifically saying appropriations do not include funding for intervenors. Also . . . recent congressional action to deny funds for a Federal Energy Regulatory Commission program for intervenor funding adds uncertainty to such programs.462/

461/ Id., Kennedy depositon at 167-169.

462/ Nucleonics Week, supra, at 5. To date, NRC has determined to obtain from the comptroller general a statement of the NRC's authority to fund intervenors, Id.

V. THE OFFICE OF NUCLEAR REGULATORY RESEARCH

The Office of Nuclear Regulatory Research (RES) engages in confirmatory research463/, rather than exploratory or developmental research. 464/ This limitation has prevented RES from researching ways to improve reactor safety.

According to a report by the NRC to Congress in April 1978,465/ RES' confirmatory research is defined as that:

> ...needed to provide a basis for evaluating applications for regulatory decisions, or to provide a basis for regulatory requirements or policy, or to provide NRC with the physical or judgmental capability to regulate the use of nuclear power... 466/

The report defines:

> ...[r]esearch for improved safety [as] research on concepts, systems, and processes believed to have potential for improving the safety of commercial nuclear power plants. Its purpose is to investigate the feasibility, benefits, and costs of implementing these concepts.467/

The conference report on the Energy Reorganization Act stated that RES' research capacity should be limited to confirmatory research.468/ As a result, the NRC's research program has been "in a principally reactive mode and left the NRC little initiative to conduct research in areas that could lead to the development of improved reactor safety systems."469/

463/ Budnitz deposition (Aug. 27, 1979) at 26; NUREG-0438, "Plan for Research to Improve the Safety of Light-Water Nuclear Power Plants" (April 12, 1978), at 5.

464/ Levine deposition (Aug. 8, 1979) at 4-5, Budnitz deposition (Aug. 27, 1979) at 4-7; See also, 1978 NRC Annual Report at 179.

465/ NUREG-0438, supra.

466/ Id. at 5.

467/ Id. at 4-5.

468/ Id. at 5.

469/ Id.

To implement its confirmatory research mandate,470/ the NRC developed a "User Office Request Procedure" for RES.471/ As it currently exists, RES is entirely dependent on the approval of particular research projects by other NRC offices:

> Either [RES] formulates a research project and goes to another office and seeks their endorsement and then if the endorsement is forthcoming, the research can proceed, or the other office writes a letter to our office asking us to perform certain kinds of research and then we answer back with a research project that we have formulated that goes along the lines required and then they endorse it.472/

Of the other NRC offices' ability to affect RES' research activities, Robert Budnitz, the RES Deputy Director, stated: "[t]hey are very heavily involved in our project by the ability they have to refuse endorsement ...the effect of another office failing to endorse a project is generally to result in our having to do what the other office wants to do."473/

As a result of the requirement that RES research projects be approved by user offices, coupled with NRC's emphasis on confirmatory research,

> ...there is a very stifling attitude within the office amongst the members [of RES] who now have sometimes come to me with a good idea which they have not fully developed because they know they can not sell that idea to one of the user offices or they have been turned down last year or last month on some similar or different idea...
>
> It is too difficult for them so they generally end up with much less initiative, much less exploratory research than would be the case if this [user] procedure ... wasn't present. Now, the end result, I think, is negative on balance towards the achieving of the Agency's mission... 474/

470/ Budnitz deposition (Aug. 27, 1979) at 4-7, and exhibit 4.

471/ Id.

472/ Id. at 5.

473/ Id. at 5-7.

474/ Id. at 7.

The 1978 Budget Authorization Act statutorily permitted NRC's research office to perform exploratory research for improved reactor safety.475/ As a result, in April 1978, the agency identified several research projects whose results would

> ...serve to place in better perspective the extent and suitability of potential improvements in the safety of light-water nuclear power.476/

However, the research proposal has made little progress. According to NUREG-0438, the NRC requested a total of $14.9 million for improved reactor safety research to be spent over three years.477/ NRC Chairman Hendrie formally requested this level of funding for safety research in the agency's 1980=1982 budget estimates, and $4.3 million for the first year.478/ However, RES' entry into exploratory or improved safety research was opposed by other NRC offices.479/ The RES proposal was followed by submissions of

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475/ NUREG-0438, supra, at 5; See also, Conference Report, Nuclear Regulatory Commission Authorization for Appropriations for Fiscal Year 1978, Report No. 95-788, Nov. 1, 1977.

476/ NUREG-0438, supra at 44-45.

477/ Aug. 31, 1978 letter from NRC Chairman Joseph Hendrie to James T. McIntyre, Jr., director, Office of Management and Budget at 3-4. See also, NUREG-0438 at viii. No funds were requested in fiscal year 1979 since, at the time the safety research was proposed, the 1979 NRC budget was "already locked up." Briefing by Saul Levine to Office of Management and Budget for fiscal year 1971, Sept. 15, 1979.

478/ Aug. 31, 1978 letter from Hendrie to McIntyre, supra, at 3-4. OMB reduced the 1980 RES request for the initiation of a light water reactor Improved Safety Research program to $1 million and specified that these funds "shall not be used for physical experimentation or improved reactor safety systems or components." Letter from McIntyre to Hendrie, Jan. 31, 1979, at 2. Instead, $7 million was given to the Department of Energy to carry out such research in order to "maintain NRC's normal independent role as the agency responsible for reviewing licensing applications for new reactor safety systems and concepts." Id. This division of responsibility is to avoid "any real or even apparent conflict of interest." Letter from Eliot R. Cutler (OMB) to Joseph Hendrie, Jan. 31, 1979, at 1.

479/ Budnitz deposition (Aug. 27, 1979) exhibit 5; (July 19, 1979 letter from Max Carbon, Chairman, ACRS, to Joseph Hendrie, Chairman, NRC).

> ...written responses denying our initiative from the two most important offices, NRR and NMSS ... [which] believe the research program should be totally responsive to them but our view is that notion ends up with an overall research program that is much too short-ranged, much too inbred, not exploratory enough, that has the attributes of solving today's problems or tomorrow's problems but not next year's problem, that has the difficulty of being too narrow, not broad enough.480/

480/ Budnitz deposition (Aug. 27, 1979) at 8-9, as corrected by errata sheet.

VI. INSPECTION AND ENFORCEMENT

INTRODUCTION

The quality of information obtained by NRC from its licensees and the extent to which it is used determine the quality of NRC's regulatory decisions; the quality of the information and the methods by which it is obtained tend to affect its credibility. Obtaining information for NRC about commercial reactors is a prime function of the I&E. Unlike NRC's Offices of Nuclear Reactor Regulation (NRR), Nuclear Material Safety and Safeguards (NMSS), and Nuclear Regulatory Research (RES), all specifically created by the Energy Reorganization Act of 1974, I&E was created by the NRC itself in January 1975 for the purpose of carrying out the NRC's inspection and enforcement activities.481/

The "Inspection and Enforcement" section of this report examines a number of I&E practices that operate to reduce the quality, reliability and credibility of NRC's regulatory activities. One commentator noted that the quality and credibility of AEC regulatory decisions suffered from an overreliance on information generated by industry. 482/ In 1978, GAO reported the same deficiency in NRC's inspection effort, which entailed virtually complete reliance on utilities and vendors to monitor themselves and report on deviations from acceptable standards.483/

In March 1979, NRC inspectors were still relying on licensees to report, analyze, and correct safety problems, despite the industry's recognized heavy financial disincentives to do so. In fact, following the TMI accident, NRC's director of the Division of Systems Safety stated that the "system of regulation depends upon the judgement of the licensee" because there is "no human way possible to do it differently," given the people and resources assigned to the task.484/

Other deficiencies in I&E's activities include the absence of any procedure for systematic evaluation of the operating information that I&E receives; I&E's apparent inability to resolve safety concerns raised by persons within the NRC staff; I&E's perpetuation of deficiencies originating in the licensing process -- for example, I&E does not take the SRP into account if NRR failed to take it into account during the licensing phase and I&E equipment inspections are generally confined to those components and systems that are labelled safety-related during the licensing phase; and I&E's lax enforcement effort.

481/ July 1975 letter from the comptroller general to Senator Abraham Ribicoff at 1.

482/ Rolph, supra at 158-159.

483/ "The Nuclear Regulatory Commission Needs to Aggressively Monitor and Independently Evaluate Nuclear Power Plant Construction," GAO Report EMD 78-80 at 5.

484/ Mattson deposition at 141-142.

A. I&E'S RELIANCE ON UTILITIES AND VENDORS TO MONITOR THEMSELVES AND TO REPORT DEVIATIONS FROM ACCEPTABLE STANDARDS

I&E inspections are conducted throughout preconstruction activities, construction, preoperational testing and startup, operation, and decommissioning of nuclear power plants.485/

According to the NRC, inspections are supposed to determine whether licensees are complying with NRC requirements; to identify conditions that may adversely affect public safety, security, the environment, or the safeguarding of nuclear materials and facilities; to provide NRC with information that may develop a basis for the granting, denial, or amendment of a limited work authorization, CP or OL; and to determine whether licensees and their contractors and suppliers have implemented adequate quality assurance programs.486/

I&E inspections fall into two categories: routine and reactive. During routine inspections inspectors are supposed to determine the effectiveness of quality assurance systems "by observing work in progress, checking records, interviewing people, and where appropriate, making direct measurements."487/ Reactive inspections are conducted in response to information regarding conditions or events affecting facilities or materials under NRC jurisdiction. LERs, prepared by the utilities, are a primary source of such information. Information may also come from license applicants, contractors, suppliers, licensee employees, routine inspections, and members of the public.488/

When an event with safety significance occurs at a nuclear power plant, the licensee is expected to report the event by telephone to the regional I&E office, and to follow this by submitting a written LER to I&E. The LER is expected to contain a description of the event, a commitment to further evaluate the event, and proposed corrective actions.

485/ NRC 1978 Annual Report at 102; Boyd deposition at 20-21; Grier deposition at 9-12.

486/ NRC 1978 Annual Report at 18, 102.

487 NRC 1978 Annual Report at 102; July 24, 1979 letter from Victor Stello to John Kemeny, enclosure at 1-3.

488/ NRC 1978 Annual Report at 102. In addition to inspections, I&E conducts full investigations of a variety of radiation incidents, equipment problems, loss or theft of licensed materials, and other allegations and complaints received by NRC, Id. at 106. Although most events can be handled during routine or reactive inspections, others may be the subject of a special investigation, which can occur when there is a reason to believe that all of the facts have not been brought forward in the normal course of events (Seyfrit deposition at 24). According to the NRC, the basic purpose of such investigations, as for all I&E actions, is to identify problem areas or safety issues, and to take corrective action or recommend changes to the regulatory process. (NRC Annual Report at 101.)

Through its regional inspectors, I&E then inspects to determine whether the licensee's actions, either taken or proposed, are appropriate.489/

Matters reported by other NRC units, which require inspection or investigation, are assigned to I&E inspectors in the appropriate region. The regional inspector then seeks the necessary information from the licensee, or goes to the plant to gather the information.490/ The inspector includes the information obtained in his inspection report, which is transmitted to I&E headquarters in Bethesda, Md.491/ Although the NRC unit that initially raises a concern with I&E would not normally be kept abreast of the ongoing inspection, it would be advised of I&E's resolution of the matter.492/

Nevertheless, in its "Report on the 1978 Opinion Survey Among the Employees of the Office of Inspection and Enforcement," prepared for the NRC, the Opinion Research Corporation found that:

> Employees in the regional offices are more likely to feel I&E Manual Chapters on Inspection Procedures are not well organized compared with employees at headquarters where a majority say the Manual Chapters are well organized. Inspectors are the only group where a majority of employees feel the Inspection Procedures are not clearly written and understandable.
>
> Inspectors are also the exception with regard to the inspection procedures providing adequate guidance to plan an effective inspection. Compared with other employees at I&E, twice as many inspectors feel the inspection procedures do not provide adequate guidance. A majority of inspectors also believe the inspection procedures do not provide sufficient technical guidance.493/

Some sections of the I&E Manual require inspectors to obtain information during the facility construction, preoperational, startup, and operation phases, "through direct observation, personnel interviews, and review of facility records and procedures."494/

489/ Seyfrit deposition at 32; see also, Gossick deposition at 90; Grier deposition at 26.

490/ Seyfrit deposition at 26.

491/ Id. at 27; TMI Commission hearings, Creswell testimony, Aug. 22, 1979, at 70.

492/ Seyfrit deposition at 10, 27.

493/ Opinion Research Corporation, "Report on the 1978 Opinion Survey Among the Employees of the Office of Inspection and Enforcement - United States Nuclear Regulatory Commission," November 1978 at 248.

494/ Inspection and Enforcement Manual, Chapters 2512(B), 2513(B), 2514(B), 2515(b). (Emphasis supplied.)

Other I&E procedures can lead to differing interpretation by inspectors. For example, another procedure requires inspectors to obtain information,

> . . . for events selected for follow-up [by conducting] record review, direct observation <u>or</u> discussion with licensee personnel to the extent necessary to complete the applicable inspection requirements.495/

According to Karl Seyfrit, I&E's former assistant director for Technical Programs and now director of Region IV, if an LER describes a system or equipment malfunction, the inspector should look at the specific piece of equipment to determine what triggered its failure and whether it has been properly repaired. 496/ An inspector may rely solely on utility-generated records, rather than actual inspection, but this is unusual and "somewhat unlikely."497/

However, Donald Haverkamp, a regional I&E reactor operations inspector and the project inspector for TMI-2 prior to the accident, did not follow the practice outlined by Seyfrit. Shortly before the accident, Haverkamp inspected TMI-2 while following up on several LERs.498/ Although one of the items was safety-related, and another item had been raised in a "prompt report,"499/ Haverkamp completed his inspection of TMI-2 without examining any pieces of equipment. 500/ Instead, he relied solely on documents supplied by Met Ed and possibly on talks with Met Ed employees. 501/ Haverkamp believed that his inspection was within the requirements of the I&E Manual.502/

495/ Id., Chapter 9200, Procedure No. 92700B (Jan. 1, 1979), Section II (Inspection Requirements) at II-1. (Emphasis supplied.)

496/ Seyfrit deposition at 84.

497/ Id. For example, if the failed part, such as a bearing or seal, had been destroyed as a part of the accident, examination of the part would not be practical, and the inspector would have to rely on utility-generated records in determining what maintenance, modifications, and design changes were made to correct the problem (Id. at 84-85).

498/ Haverkamp deposition at 12-18.

499/ A prompt report requires a telephone report within 24 hours of the event and a written followup report within 14 days for certain occurrences designated in the technical specifications. 10 CFR 20. 403(b) (24-hour notification); Haverkamp deposition at 19; TMI-2 Technical Specification 6.9.1.8.

500/ Haverkamp deposition at 13-18.

501/ Id. at 13-16, 18-19, 21-22.

502/ Id. at 10-11.

In a Sept. 7, 1978, report entitled "The Nuclear Regulatory Commission Needs to Agressively Monitor and Independently Evaluate Nuclear Power Plant Construction," GAO found that NRC inspectors customarily:

- do little independent testing of construction work, and rely heavily upon the utility company self-evaluation;
- spend little time observing ongoing construction work; and
- do not communicate routinely with people who do the actual construction work.503/

GAO concluded that, without a more thorough and independent evaluation of the quality of powerplant construction work,

> ' . the [NRC] Commission has to rely excessively on the credibility and validity of evaluations made by utility companies and their contractors and cannot independently assure that powerplants are being constructed adequately.504/

GAO's investigators found unsafe practices in construction management, in on-site construction work, and in manufactured components. Its investigation at the North Anna plant, in 1977, disclosed "significant problems in construction, management and in defective construction work which had gone undetected and unreported."505/ GAO concluded that NRC's inspection method:

> ' . . necessitates almost complete reliance on the utility and its contractor to monitor themselves and report deviaations from acceptable standards.506/

On July 17, 1978, the NRC executive director for operations, Lee Gossick, responded, by letter, to the GAO report, in part, as follows:

503/ GAO Report EMD - 78-80 at Id.

504/ Id. at iii; See also, Moseley deposition at 6; Anderson, Donald G., deposition at 7-10; Eisenhut deposition at 16-17.

505/ GAO Report EMD-78-80 at 2.

506/ Id. at 5. NRC Commissioner Gilinsky testified that "[o]ne of the problems we have is that industry has taken the view that they will do just what the NRC requires and no more. It's true, that since the industry designs these plants, operates these plants with only an audit by the government safety experts that the system - the safety of the public depends very heavily on the performance of the industry . . . . The fact is, however, that private and public incentives differ. And they have a balance sheet that they are concerned about. And it's undeniable that that affects their judgement in matters that bear on safety." (Gilinsky deposition at 75-76.)

> . . . NRC does not see totally independent assurance as a role for NRC inspection. . . 507/

NRC's 1978 Annual Report, dated Feb. 14, 1979, described its inspection program as "pyramidal" -- contractors and licensees are expected to conduct the quality audits and inspections with occasional NRC "spot-checks" of the work done by the licensee and its contractor.508/

Reliance on licensees to largely regulate themselves inevitably creates problems. For example, unless the matter is covered by a technical specification, the licensee is not required to report to NRC modifications to the plant, even when a safety-related item is involved, so long as the change "does not significantly change the function of that safety-related component. 509/ It is the licensee who determines whether to make the modification, whether it produces a significant change, and hence whether it must be reported to the NRC.510/ Yet, a clear financial disincentive exists for licensees and vendors to report that safety-related modifications are necessary because they may be forced to pay for the modification. Contacts between vendors and utilities commonly provide that the vendor will supply "licensible" equipment. As a result, the cost of equipment to meet new regulatory requirements is borne by the vendor. Should a modification not be required by the NRC, the utility would bear the cost. Utilities are thus encouraged to wait for the NRC to act. Also, according to NRC Chairman Hendrie, vendors are reluctant to propose a modification to a plant for fear that the NRC will mandate that it be supplied to all other like plants.511/

> COMMISSIONER PIGFORD: And, of course, we can see the problem. We can see if only [the licensee] asks for it [a safety-related modification], then maybe [the vendor] is not going to absorb the cost and apply it to all of its future customers or to its grandfather customers . . . They just give it to TVA.
>
> * * *
>
> EBERSOLE: To me the problem is shall safety features developed by utilities and architect engineers . . . [a]nd vendors have a better way of emerging for consideration by the regulatory processes?

507/ GAO Report, EMD-78-80, Appendix I at 35.

508/ NRC 1978 Annual Report at 103; see also, Kennedy deposition at 72 ("the job is simply too great" for NRC to participate in every aspect of operations); Bradford deposition at 29-32.

509/ Seyfrit deposition at 63.

510/ Id.

511/ Hendrie deposition at 172-177; TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 161-162.

> PIGFORD: . . . [B]ut now here is a financial threshold barrier, and this present barrier says, "Wait until NRC does it, and then it won't cost you so much on an individual basis." Are we stuck with that or am I making up something that is not real?

> EBERSOLE: No, I think to some degree we are stuck with that. A finding made by an individual deep in an organization which implies heavy costs which is not a regulatory requirement is not likely to be encouraged by what I call the shell of middle management.512/

One specific example of problems created by I&E's reliance upon a licensee concerns a transient which occurred at Davis-Besse Unit 1 on Sept. 24, 1977. It had significant characteristics in common with the TMI-2 accident: a PORV stuck open; the pressure in the primary system dropped causing HPI to automatically actuate; pressurizer level rose; as a result the operator manually terminated the HPI.

On Sept. 25, 1977, Toledo Edison, the Davis-Besse licensee, reported the event to NRC Region III, but failed to mention that the operator terminated HPI despite the continuing loss of coolant from the primary system. A few days after the transient, either Roger Mattson, the Director of the DSS in the Office of NRR, or his deputy, Denyood Ross, sent Gerald Mazetis, a reactor systems engineer, to the Davis-Besse site to "get the straight scoop" on the transient.513/

On Friday, September 30, a meeting concerning the transient was held at the site. The meeting was attended by 32 representatives from NRC Headquarters (including Mazetis), the NRC Regional Office, Babcock & Wilcox, Toledo Edison, and Bechtel Corporation, the Davis-Besse architect-engineer.514/ A meeting of this type would only be called to consider a significant matter.515/

> [I]t is somewhat unusual for that kind of meeting to occur. It is not something that happens as a routine matter.

> At the time this occurred, Davis-Besse had just recently been licensed, was in the process of getting the plant operating; and there had been some difficulties with various aspects of the final review prior to issuing a license. So there was a high degree of interest.

512/ TMI Commission hearings, Ebersole testimony, Aug. 22, 1979, at 161-163.

513/ Mazetis deposition at 21.

514/ Seyfrit deposition at 28-29; Engle deposition at 24.

515/ Seyfrit deposition at 28; TMI Commission Hearings, Mattson testimony, Aug. 22, 1979, at 236.

> And to have this kind of transient occur, I think raised a number of questions. Had the review been adequate? Had we really licensed too soon; and that kind of question.516/

On his return to Bethesda, Md., Mazetis prepared a trip report in which he noted the principal events of the transient, mentioning that the operator had terminated HPI. In the summary to his report, Mazetis stated:

> The event was a loss of feedwater compounded by two additional single active component failures. Power level was 10 percent. Although the event itself was fairly significant (and many questions will have to be addressed), probably the most intriguing part is the endless "what ifs" which could keep anyone busy for a long while. . . . 517/

A meeting was held in Mattson's office on Monday, Oct. 3, 1977, concerning the transient. The meeting was attended by Karl Seyfrit, then assistant director for technical programs in I&E, and liaison between I&E and M.518/ At the conclusion of the meeting, Seyfrit, on behalf of I&E, assumed responsibility for obtaining further necessary data.519/ It was decided that I&E would retain lead responsibility for the transient, with Mazetis of DSS available for advice and consultation.520/

On Oct. 20, 1977, Ross sent a followup memorandum to Seyfrit on the October 3 meeting, listing the specific items to be addressed in I&E's report on the September 24 transient.521/ Item 2 in the memorandum states:

> The operator's role in participating in the event should be related. . . .The operator's decision to secure HPI flow based on pressurizer level indication should be explained.

After the TMI-2 accident, Seyfrit was unable to provide any documentation that the concerns raised by Mazetis, and reiterated in Ross' memorandum, had been relayed to the regional inspectors, and he had no recollection that this had in fact been done.522/

516/ Seyfrit deposition at 2829.

517/ Ross deposition, exhibit 6.

518/ Seyfrit deposition at 5-6; Mazetis deposition at 44; Engle deposition at 26-27.

519/ Mazetis deposition at 44-45; Engle deposition at 27.

520/ Mattson deposition at 69; Engle deposition at 27.

521/ Mazetis deposition at 45-46.

522/ Seyfrit deposition at 26-33.

On Nov. 14, 1977, Toledo Edison provided NRC with a lengthy supplemental report on the September transient. Operator termination of HPI should have been addressed in this report.523/ However, the report summary contains no discussion of operator termination of HPI based on rising pressurizer level despite continuing loss of primary system coolant. It merely states without explanation that the operator stopped the high pressure injection pumps at 6 minutes, 14 seconds into the transient, and it concludes that "operator action was timely and proper throughout the sequence of events."524/

On Nov. 22, 1977, the final I&E inspection report was submitted by the NRC regional inspectors. This report, according to Seyfrit, would have been the means by which I&E informed Mattson's office of the evaluation of the Mazetis concerns.525/ However, I&E's report merely states "HPI pumps were shutdown . . . as pressurizer level was normal".526/

Mattson has testified that he did not recall receiving any report from I&E regarding the Mazetis concerns. He took no steps to follow up.527/ Mazetis also testified that he did not recall receiving any such I&E report. He did not follow-up and he did not prepare a review reminder for RSB engineers on the concerns he had raised because he assumed that enough was already being done.528/

Another example is Met Ed's failure to report its procedural change, instituted in August 1978, of closing the EF-12 valves during emergency feedwater pump testing, even though the procedure is safety-related.529/ That change violates the TMI-2 technical specifications 530/ and a licensee may not institute such changes without prior NRC approval.531/ TMI inspector Haverkamp was unable to explain why neither the procedure

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523/ Id. at 67.

524/ Nov. 14, 1977, Supplemental Report from Toledo Edison at 2, 4; Tambling deposition at exhibit 3.

525/ Seyfrit deposition at 25-27.

526/ Inspection Report No. 50-346/77-32, Nov. 21, 1977, Tambling exhibit 2 at 5; see also, Tambling deposition at 48-49.

527/ Mattson deposition at 70-72; TMI Commission Hearings, Mattson testimony, Aug. 22, 1979, at 247-238.

528/ Mazetis deposition at 41-43.

529/ Grier deposition at 53; Gallina deposition at 41-43.

530/ Haverkamp deposition at 34-35; Thadani deposition at 54-55; see also, TMI-2 Technical Specification 3.7.1.2.

531/ Haverkamp deposition at 36.

change request nor the procedure change was called to his attention by the licensee prior to the accident.532/

Haverkamp had also not been advised, prior to the TMI-2 accident, that Met Ed had not maintained current ("as built") plant design drawings, even though this failure may constitute a noncompliance or deviation from technical specifications.533/ Richard Vollmer, director of the NRC's TMI Support Task Group, testified at his deposition that Met Ed's failure to maintain such plans had a "time impact" on the efforts to devise methods for dealing with the March 1979 accident.534/

Another example which raises questions about NRC's reliance on licensees to recognize, correct, and report the safety implications of operating events involves the 1974 transient at NOK-1, Beznau, Switzerland. Information about foreign transients usually goes initally to NRC's Office of International Programs. Such information would ultimately be transmitted to domestic licensees via I&E Bulletins. Although Westinghouse, export license vendor of the Beznau plant, had 23 plants operating in this country, the NRC was not notified of the transient until April 1979, when ". . . Westinghouse mentioned that there had been an accident involving a stuck PORV valve in an incident in Europe."535/

A Sept. 4, 1974, report from the files of Westinghouse sets forth the Beznau transient in detail. 536/ On Aug. 20, 1974, a turbine tripped at the NOK-1 nuclear facility. The two PORVs on this plant opened to relieve excess pressure. One PORV closed and the other stuck open. While pressure fell, level rose and remained off-scale high for 3-5 minutes. Steam bubbles formed in the primary system. Nevertheless, the automatic HPI, which actuated only if pressure and level were trending together, did not come on. Several minutes into the event, the operator recognized the PORV failure and closed the block valve. Pressurizer level then fell rapidly and, at about 12 minutes into the event, the HPI automatically actuated by both low pressure and low pressurizer level.537/

532/ Id. at 37. Gary Miller, Met Ed's TMI-2 station manager, testified that NRC inspectors were aware of the procedure change. (See Miller deposition at 121.) But see Haverkamp deposition at exhibit 4 (Procedure Change Request Form).

533/ Haverkamp deposition at 57-58; TMI Commission Hearings, Mattson Testimony, Aug. 22, 1979, at 244; see, TMI-2 Technical Specification 6.10.2(a).

534/ Vollmer deposition at 25-28.

535/ TMI Commission Hearings, La Fleur testimony, Aug. 22, 1979, at 5-8; LaFleur deposition, Aug. 17, 1979, at 136-141.

536/ Id. at exhibit 3.

537/ TMI Commission hearings, LaFleur testimony, Aug. 22, 1979, at 5-7, 9-13, and exhibit 1.

Automatic actuation of HPI by such "coincident logic" is a design feature absent from B&W plants, such as TMI-2. By use of coincident logic, HPI automatically activates only when both pressurizer level and primary system pressure fall together. This is based on an assumption that the two will always trend together. Had that automatic design feature been present at TMI-2 at the time of the March 1979 accident, when pressure dropped and level rose, there would have been no automatic actuation of high pressure injection.

As a result of the TMI-2 accident, the danger of coincident logic for HPI actuation in Westinghouse plants became apparent to the NRC. In April 1979, the NRC issued two I&E Bulletins requiring the elimination of coincident logic.538/ This lesson might have been learned by NRC almost 5 years earlier from the transient that occurred at NOK-1, had Westinghouse reported it to the NRC. Conversely, had the Beznau operator failed to shut the block valve, the consequences of the Beznau transient might have equalled those of the TMI-2 accident. The difference would have been in the cause: not in operator action in terminating high pressure injection as at TMI-2, but a design which prevented HPI from automatically actuating. According to Westinghouse, no coincident logic safety issue had been recognized in connection with this transient and, prior to the TMI-2 accident, no change was made in the coincident logic utilized at the NOK-1 facility.539/

538/ I&E Bulletins 79-06 and 79-06A; LaFleur deposition (Aug. 1, 1979) at 67-68.

Note: The Swiss Regulatory Agency reported the NOK-1 outage to the International Atomic Energy Agency (IAEA) in 1974, and the outage was reported in IAEA's "Operating Experience with Nuclear Power Stations in Member States in 1974" (Sept. 25, 1974, letter from Joseph D. LaFleur, Jr Deputy Director, Office of International Programs, to the President's Commission, Attachment 5). However, the report contains no mention that coincident actuation of ECCS failed on account of divergence of pressure and pressurizer level (Id.; see also, Mattson deposition at 111; Esposito deposition at 23-25.)

539/ Anderson Thomas deposition at 6-7, 10; Esposito deposition at 13-14. See also, Westinghouse Report on NOK-1, dated Sept. 4, 1974, at 8. Interestingly enough, in 1971, Westinghouse had reported a boric acid corrosion problem at Beznau to the AEC. (See, Sept. 19, 1979 letter from Jospeh D. LaFleur, Jr., Deputy Director, Office of International Programs, to the President's Commission, (enclosure); see also, Hanauer deposition exhibit 4, and at 11, 14-17, 28.) At the request of Commissioner Pigford, Westinghouse submitted information received Oct. 22, 1979, stating that it had submitted analyses to the AEC 2 years before Beznau showing that if a PORV stuck open, HPI on a Westinghouse plant might not automatically actuate "but that ample time (more than 50 minutes) was available for operator action." Letter from W. Jacobi to John Kemeny. Westinghouse also stated that "prior to TMI, Westinghouse simulator training programs included an exercise in which operators were trained to identify and isolate an open PORV within one minute." Id.

The Beznau transient raises questions about NRC's reliance upon vendors to recognize and report the safety implications of operating events. It also raises the question of the adequacy of the international exchange of information in this industry. 540/ Clearly, the details of the Benzau transient would have been of value in indicating that, for automatic HPI actuation and for operator instructions dealing with ECCS manipulation, pressurizer level and primary system pressure can move divergently during a transient, rather than coincidentally:

540/ NRC's present requirements do not provide that the export licensee, such as Westinghouse, must report all foreign transients and accidents. Rather, the export licensee is required to report only those events that it determines "reflect some kind of a deficiency with regard to safety in the reactors in this country for which they are responsible. . . Westinghouse . . . did not seem to be concerned that this was a major incident or would involve other reactors." (TMI Commission hearings, LaFleur testimony, Aug. 22, 1979, at 17;) LaFleur deposition (Aug. 1, 1979, at 15, 82; see, 10 CFR Part 21.) At the time of the Beznau transient, no formal reporting agreement existed with Switzerland. (TMI Commission Hearings, LaFleur testimony, Aug. 22, 1979, at 8-9; Agreement between the United States and Switzerland, Dec. 9, 1974.) Therefore, the Swiss government was "not obliged" to advise the NRC of the event. (Id.)

Based on current requirements, the NRC relies exclusively on the voluntary acts of foreign governments to discover, recognize the safety significance of, report and correct a problem with a foreign reactor. (TMI Commission Hearing, LaFleur testimony, Aug. 22, 1979, at 17.) Although this country is a party to information sharing agreements with many foreign countries having nuclear reactors (LaFleur deposition, Aug. 1, 1979, at 12-14, the NRC "has always [had a] policy not to require a safety cooperation agreement as a condition of [an export] license" (LaFleur deposition Aug. 1, 1979, at 14; Aug. 17, 1979, 137-138) and an inter-governmental agreement has not been a pre-condition to the granting of an export license to a vendor. (LaFleur deposition, Aug. 1, 1979, at 13.)

If such an agreement is made, production of information by the foreign government remains voluntary. (Id. at 14.) Even when a foreign government decides to notify the NRC of a transient, confidentiality conditions may be unilaterally attached to the information, barring public release by the NRC. (Id. at 38.) Furthermore, the information actually provided to the NRC from foreign countries "may be very well laundered . . . before it is released."

Although the NRC is the agency that issues an export license to the nuclear steam supplier (Id. at 6-8), the decision to issue the license is actually made by the Executive Branch. If the State Department determines that issuance of a license "will not be inimical to the national [U.S.] security," the license is normally issued. The State Department "does not concern itself with domestic health and safety" in making its decision. (Id. at 9.) Neither does the NRC consider the health and safety effects of the export of nuclear reactors. (Id. at 9-10.)

QUESTION: . . . [I]t is clear, is it not, that it is safer . . . to have ECCS [including high pressure injection] based upon either level or pressure, rather than coincident to both?

THADANI: In my opinion, yes.

QUESTION: What would be your explanation for why that perception of increased safety was not realized and implemented by the NRC prior to March 28, 1979?

THADANI: Simply the lack of understanding that there were events where the pressure can go down while the level, in this case the pressurizer level, may not go down.541/

B. I&E's APPARENT INABILITY TO RESOLVE SAFETY CONCERNS RAISED WITHIN ITS STAFF

The difficulties encountered by NRC Regional Inspector James Creswell, in his effort to focus NRC attention on safety concerns at Toledo Edison's Davis-Besse reactor, demonstrate I&E's inability to resolve safety concerns raised by the staff.

Creswell is an I&E inspector from the Region III office in Chicago. In mid-1978, he was requested by a project inspector, Thomas Tambling, to investigate the details of a transient that occurred at the Davis-Besse plant on Nov. 29, 1977.542/ In the course of this investigation, Creswell learned that, during the Sept. 24, 1977, transient at Davis-Besse, the operator had prematurely terminated high pressure injection.543/

Creswell noted the problem in a series of inspection reports, beginning in October 1978, and in requests for technical evaluation by NRR. In Report No. 50-346/78-27, Creswell reviewed HPI performance during the September transient and noted at page 3:

> The licensee is reviewing the operator action of . . . securing high pressure injection to determine if different actions would be advisable in the future should a similar set of conditions arise. This matter is unresolved.

Over a period of approximately 5 months, Creswell was unable to obtain any action from his supervisors in I&E or from the licensee.544/

541/ Thadani deposition at 73.

542/ TMI Commission hearings, Creswell testimony, Aug. 22, 1979, at 66; Creswell deposition at 9-10.

543/ TMI Commission hearings, Creswell testimony, Aug. 22, 1979, at 66-67; Creswell deposition at 14-16.

544/ Creswell deposition at 51-52.

He was informed that, on the basis of a report from Toledo Edison, NRR considered the matter resolved to its satisfaction. Yet Creswell was unable to ascertain from NRR whether any documentation existed concerning that evaluation. He was told by the NRR project manager for Davis-Besse that no documentation existed. 545/ And he was advised that he was acting beyond the scope of his responsibility in pursuing the matter.546/

Finally, in mid-February 1979, Creswell elected to exercise the "open door" policy whereby any NRC employee may express safety concerns directly to any superior, including the NRC commissioners. Creswell had several telephone conversations with NRC Commissioner Bradford and his technical assistants in which he expressed his concern over operator interruption of HPI during the September transient. After one of Commissioner Bradford's technical assistants confirmed that NRR had no documentation on this, Creswell submitted written information from his inspection reports and a description of his concerns to NRC commissioners Bradford and Ahearne.547/

Commissioners Bradford and Ahearne met with Creswell in Washington, D.C., on March 21, 1979, to discuss Creswell's concern about the operator's manual override of HPI.548/ Seven days later, the accident at TMI-2 occurred.

Creswell had no greater success in pursuing his investigation of the Nov. 29, 1977, transient at Davis-Besse, which involved loss of pressurizer level indication off the low end of the scale. By April 1978, he had determined from the utility's records that pressurizer level indication had gone off-scale low for 5 minutes. 549/ He continued to seek a satisfactory resolution to this problem for 14 months from the utility, the NRC regional office, and from NRC Headquarters. In several of his reports, Creswell noted that he had frequently requested Davis-Besse's documentation that this was not an unreviewed safety question. Finally, in December 1978, he was informed by Toledo Edison, the licensee, that no analysis of the problem had been done.550/

545/ Id. at 75-77.

546/ TMI Commission hearings, Creswell testimony, Aug. 22, 1979, at 69.

547/ Id. at 75-76; Ahearne deposition at 48.

548/ Creswell deposition at 106-107. Victor Stello, the present director of I&E, has stated that Creswell believed the HPI termination during the September 1977 transient "was an operator error which needed to be corrected by Davis-Besse" and was a site-specific issue only. Letter from Victor Stello to Stanley M. Gorinson, President's Commission, Sept. 7, 1979, Item 4.

549/ Inspection Report 50-346/78-06, April 20, 1978.

550/ Creswell deposition at 144.

On Dec. 22, 1978, B&W provided an analysis to Toledo Edison, NRC Region III, and NRC Headquarters, indicating that a change in the water level of the steam generator would correct the pressurizer level problem. The next day, during a conference call involving NRC Headquarters, Region III (Creswell's office), and Toledo Edison, everyone except Creswell agreed that the proposed solution was acceptable.551/

In January 1979, Region III began its own attempt to resolve Creswell's concerns about loss of pressurizer level indication. This included a Feb. 14, 1979, meeting at B&W with representatives from four B&W plants (including Met Ed) concerning loss of pressurizer level off the low end of the scale. At this meeting, loss of pressurizer level off-scale low was found to be only an "operational inconvenience," and not a safety concern. During the course of the meeting, an NRC inspector was told by one of the inspectors from Creswell's office that the meeting was being held to "shut [Creswell] up."552/

After many months of unsuccessful attempts to have his concerns regarding loss of pressurizer level resolved through normal channels, Creswell resorted to what he perceived to be a faster alternative: licensing board notification. Because NRR had already concluded that no safety problems existed, based on the licensee's report, Creswell chose not to contact NRR.553/ He sought instead to have his concerns scrutinized in the public arena of pending licensing boards for other proposed plants.554/

551/ Id. at 52-62.

552/ Anderson, Donald G., deposition at 45-46; but see, Foster deposition at 69-72.

553/ TMI Commission Hearings, Creswell Testimony, Aug. 22, 1979, at 84-85, 88.

554/ Id. at 82. An I&E inspector, among other NRC personnel, may request that a licensing board review a particular concern he may have discovered. In order to seek board review, the matter must involve a safety problem; it must be thought of as a generic problem (applicable to more than one reactor); and it must be "relevant and material." The agency has established a procedure that, if upon review, the matter is considered not the type to go to a licensing board, but the originator still concludes it is, the problem is forwarded for board resolution. Even if the matter involves an operating reactor, a safety concern would be reviewed by any licensing board reviewing the same plant steam system supplier's design. (Jordan deposition at 59-68; Shapar deposition at 32-33, 35-38; NRC Inspection and Enforcement Manual, chapter 1530, "Policy and Procedure for Conveying New Information to Licensing Boards" (July 26, 1978) and Enclosure 1 to MC 1530; see also, IE Bulletin 79-05 (April 1, 1979), Enclosure 2 at 2-3; Sept. 7, 1979, letter from Victor Stello, NRC, to Stanley M. Gorinson, President's Commission, Item 4).

On Jan. 19, 1979, Creswell's questions about the November 1977 Davis-Besse transient were forwarded to NRC Headquarters in a formal request for licensing board notification. 555/ Although this process is supposed to take less than 15 days, some 2-1/2 months later the licensing board had still not been notified.556/

On March 28, 1979, I&E concluded that Creswell's concern presented no unreviewed safety question. 557/ On March 29, the day after the TMI-2 accident, I&E decided to review the matter again.558/ On April 5, 1979, I&E Bulletin 79-05 was sent to licensees, warning of the TMI-2 accident and incorporating a portion of a Creswell memorandum dealing with the Davis-Besse pressurizer level off-scale low problem. According to Victor Stello, the present director of I&E, this problem is much less significant than the Sept. 24, 1977, Davis-Besse pressurizer level problem. No operator confusion would be expected in a loss of pressurizer level off-scale low transient.559/

Regarding Creswell's difficulties in raising safety problems that the agency did not deal with prior to the TMI-2 accident, Harold Denton, director of NRR, stated:

> . I did make a determination that they [Creswell's concerns] had not been adequately addressed and they were the type of concerns that in hindsight should have been evaluated and brought to NRR's attention for mutual consideration between both offices. I thought they were definitely valid concerns.
>
> Without a doubt many of Creswell's concerns were right on the mark. I say that with the benefit of hindsight. In the discussions I had with him and I think from the understanding I now have, that I sure wish I had known thoroughly of his concerns earlier. But, whether I would have recognized them as clearly before the TMI accident as I do now is hard to say.560/

555/ Jan. 19, 1979, letter from James Keppler, Director, Region III to N. Moseley and H. Thornburgh, NRC I&E Headquarters.

556/ Jordan deposition at 63; Shapar deposition at 30-31; see also, Moseley deposition at 99-102.

557/ March 28, 1979, memorandum from N. Moseley, I&E, to D. Thompson, I&E.

558/ March 29, 1979, memorandum from N. Moseley, I&E, to D. Thompson, I&E.

559/ Letter from Victor Stello, NRC, to Stanley M. Gorinson, President's Commission, Sept. 7, 1979, Item 4.

560/ Denton deposition at 57, 80.

Creswell's frustration in attempting to raise safety concerns within the NRC is nothing new:

> KEMENY: Is the kind of experience you had in trying to followup the two Davis-Besse incidents unique in your opinion in NRC procedures or is it fairly typical?
>
> CRESWELL: There has been a certain history of individuals that have worked for NRC that have had problems with dealing with safety issues. That is well documented, Mr. Pollard, Mr. Conrad and others, some to the extent that they have left the Commission.
>
> KEMENY: Are you suggesting there that individuals who raise fairly consistently serious safety issues may, in the long run, find that they cannot work for NRC?
>
> CRESWELL: That they cannot work for NRC or that they would be placed in other organizations.561/

Prior to Creswell's effort, the difficulties of NRC employees such as Fluegge, Marinos, and Basdekas in raising safety concerns were "well documented" in 1976 testimony before the Senate Committee on Government Operations. 562/ According to Creswell, "[t]here have been reorganizations in the past where people have moved to different positions," but NRC management's response to safety issues raised by employees remains apparently unchanged.563/

A November 1978 study of I&E employees by Opinion Research Corporation revealed that "six in ten employees believe that many managers practice a 'don't-rock-the-boat' philosophy, [and] . . . say that decisions about how the work should be done are often made by people unfamiliar with the actual situation."564/

As a result of his experience, Creswell concluded that ". . . within the decision-making structure of the NRC [there is] a reluctance to come to grips with very serious safety issues."565/

561/ TMI Commission hearings, Creswell testimony, Aug. 22, 1979, at 79.

562/ Hearing before Committee on Government Operations, U.S. Senate, 94th Congress, 2nd Session, Dec. 13, 1976.

563/ TMI Commission hearings, Creswell testimony, Aug. 22, 1979, at 100.

564/ Opinion Research Corporation, "Report on the 1978 Opinion Survey Among the Employees of the Office of Inspection and Enforcement -- United States Nuclear Regulatory Commission," November 1978, at 150, 154.

565/ TMI Commission hearings, Creswell testimony, Aug. 22, 1979, at 79.

The NRC has taken steps following the TMI-2 accident to facilitate NRC consideration of safety concerns raised by the NRC staff.566/

C. I&E's FAILURE TO SYSTEMATICALLY EVALUATE OPERATING DATA

One of the principal responsibilities of the NRC is the "evaluation of operating experience" at licensed nuclear power facilities. 567/ The manner in which I&E has elected to implement this function begins with the licensee:

> I&E is responsible for the initial review of and response to notification of reportable events received from reactor licensees. I&E will review each such event and make a determination as to the acceptability of the licensee's corrective action or program for correction. I&E will assure that information regarding significant events is provided to NRR in a timely manner commensurate with the importance of the event. If the corrective action cannot be accomplished under the existing license requirements, if an unreviewed safety or safeguards question is identified, or if technical issues requiring special expertise not available within I&E are involved, responsibility for resolving the matter will be formally transferred to NRR. NRR will inform I&E of the resolution of any such matters.568/

A primary purpose of the event reporting system is to provide information by which the licensees, the vendors, and the NRC become aware of safety problems that should be corrected in operating plants. Yet, the record raises questions about the effectiveness of I&E's evaluation of operating information and events.

For example, as discussed supra, following the Sept. 24, 1977, Davis-Besse transient, the Division of Systems Safety (DSS) raised a concern about operator reliance on rising pressurizer level in terminating HPI. I&E accepted responsibility for follow-up. Yet DSS' concern was addressed in neither the licensee's subsequent LER nor I&E's

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566/ See, June 18, 1979, memorandum from director of Office of Management and Program Analysis to the NRC commissioners, **"Differing** Professional Opinions," and attachments.

567/ NUREG-0325, U.S. Nuclear Regulatory Commission Functional Organization Charts, at 3.

568/ Memorandum from Volgenau (I&E) and Rusche (NRR) to Gossick, March 21, 1977, at 4-5. Many of the procedures regarding divisions of responsibility between I&E and NRR are described in detail in the "Agreement of NRR/I&E Interface and Division of Responsibility," March 21, 1977.

investigation report, and no followup appears to have been done by either I&E or NRR.569/

In January 1979, GAO commented on the NRC's review of safety-related problems at operating plants:

> GAO found that the commission needs to improve its licensee report assessment procedures to better assure that it is identifying and acting on all safety-related problems. For example, the commission's review of reported events following its discovery of a safety-related problem at two operating nuclear power plants revealed that the problem had been widespread for some time. Better assessment procedures may have enabled the commission to identify this problem.570/

The absence of any ongoing evaluation of operating experience was recognized as early as 1976, when Saul Levine, present director of NRR and William McDonald, of the Office of Management and Information and Program Control, now Management and Program Analysis (MPA), circulated a draft proposal to establish an NRC group to analyze systematically "failure data for safety-related components and systems" and provide these data in "a form which can be utilized in the regulatory process."571/ However, before the proposal was formally submitted, "[i]t was fought by various people in the agency . . . [We] were opposed in doing this, so it never bore fruit."572/

In 1977 the absence of a system for keeping track of generic issues was again recognized, but to no avail, when discussion about the problem was held among Karl Seyfrit of I&E, Stephen Hanauer of NRC's Office of Nuclear Reactor Regulation, and Ernest Volgenau, then Director of I&E.573/

In 1978, according to NRC's Annual Report, the NRC staff, using 1976 enforcement data, "explored three distinct evaluation methods: (1) statistical analysis of noncompliance information, (2) trend analysis of "licensee event" data (LERs), and (3) the subjective opinions of NRC inspectors. . . ."574/ The NRC stated its expectation that the

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569/ Ross deposition at 110; Licensee Supplement to Reportable Occurrence NP32-77-16, Nov. 14, 1977, at 3; I&E Report No. 50-346/77-32, Nov. 22, 1977, at 5; TMI Commission hearings, Mattson testimony, August 22, 1979, at 237-238.

570/ GAO Report, EMD-79-16, Supra, 1979, at i.

571/ Levine deposition (Aug. 8, 1979) and exhibit 3.

572/ Levine deposition at 6-7.

573/ Seyfrit deposition at 74-76.

574/ 1978 NRC Annual Report at 4.

"program will improve the quality of regulation by providing a systematic way of identifying key factors that influence licensee regulatory performance and, at the same time, assist the NRC in allocating inspection resources more efficiently and effectively."575/ None of the methods was adopted.

At the time of the Three Mile Island accident, "there was no agency-wide function that examined operational data as the data occurred and examined them for safety significance."576/

> There was no formalized mechanism to achieve that kind of review [of operational experience at licensed reactors]. We have maintained a licensee event report file and if one is interested in specific kinds of licensee events or specific equipment failures, one can query that file and get a print-out.
>
> Other than that, we relied on individuals who did review licensee event reports and their ability to remember from one time to the next the kind of things that have happened. It was not a formalized system, however.577/

The problem also impedes I&E's function of determining which reported events warrant transfer to NRR for evaluation and correction on a generic level.578/ An example is provided by I&E's handling of a regional office suggestion, contained in a March 31, 1978, memorandum to I&E Headquarters in Bethesda. The memorandum was inspired by an event at TMI-2 where a power failure caused the PORV to fail open. While noting that the PORV is not safety-related, the memorandum requested that the adequacy of the design approach (valve failing open on loss of power) be reviewed in an expedited manner on a generic level.579/ I&E Headquarters responded to the request by referring solely to the TMI-2 FSAR, not operating experience at other plants. 580/ By virtue of the single-failure analysis employed in the FSAR, the ECCS was deemed

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575/ Id.

576/ Budnitz deposition (Aug. 27, 1979) at 62; see also, Gossick deposition at 45, 50-52; Mattson deposition at 154; Minogue deposition at 75-76; Stello deposition at 15; Seyfrit deposition at 74-80.

577/ Seyfrit deposition at 73; see also Creswell deposition at 8.

578/ Boyd deposition at 7-8.

579/ Region I memorandum, AITS number F14674H2, at 1, Sternberg deposition, exhibit 2.

580/ May 3, 1978, letter from Karl Seyfrit to E. Brunner, Region I, page 1, Sternberg deposition, exhibit 3, at 2.

sufficient to handle any PORV failure, and generic review was determined to be "not warranted."581/

I&E's failure to review operating experience is also shared by the licensee. An internal Met Ed memorandum dated June 15, 1978, poses this question:

> Are there changes which should be made in the process for acquisition and use of information about incidents at other nuclear plants as one way to forecast and avoid nuclear and radiation safety problems at TMI-1 and TMI-2?

The response to the question describes the extensive number of documents, including a bimonthly newsletter entitled "Current Events-Power Reactors," regularly received from the NRC concerning safety-related events at other nuclear power plants. The memorandum observes that the "high volume of written material" causes "unfiltered written information" to lose "a great deal of its visibility," and concludes as follows:

> 1. . . . There is some danger of the above information being buried in the plethora of written communications.
>
> 2. . . . A formally organized program to prereview and filter the incoming information and subsequently forward it to the appropriate parties would consume more manpower than would be cost affective [sic].582/

The NRC has now taken steps to organize a group to systematically review the utility-prepared LERs for operational experience. 583/ According to one NRC staff member, one reason such a group was not formed prior to the accident, was the:

581/ Id.; see also, Seyfrit deposition at 64-65.

582/ Three Mile Island GORB memorandum of June 15, 1978, at 2. Even if a utility such as Met Ed did incur the cost of filtering the NRC reports, the effective recognition of safety problems by the agency is still questionable. For example, the issue of the NRC's "Current Events-Power Reactors" describing the Davis-Besse transient of Sept. 24, 1977, makes no mention of operator interruption of high pressure injection. Although the publication contains a section entitled "Operator Error," the Davis-Besse transient was placed under "Valve Malfunctions."

583/ "Inside NRC", Aug. 27, 1979, at 7; Denton deposition at 51-52; Levine deposition, Aug. 8, 1979, at 6-7; Stello deposition at 15; Thornburg deposition at 74-75.

> . . . simple battle over whose office was going to do this and whose office was going to control it and that battle was not joined properly at the highest levels of the Agency and resolved . . . NRR wants it in their office. Research wants it in their office and I&E people want it, and important part of it is under them and nowhere else and this turf battle prevents effective progress.584/

D. I&E BULLETINS

The problems posed by NRC's reliance on industry to regulate itself are further illustrated by a series of I&E Bulletins issued to licensees following the TMI-2 incident.

The NRC's primary method for advising reactor licensees of important safety matters is through I&E bulletins. This:

> formal program within I&E [is designed] to feed back information to all licensees regarding events of safety significance at operating reactors. When an event at an individual plant is of such safety significance as to require action by other licensees, an I&E Bulletin is issued.585/

Before a Bulletin is issued, I&E must find that:

1) The event or condition [is] important to safety;

2) The event or condition [is], or has the potential for being generic in nature; and

3) Timely action is necessary by licensees or permit holders or timely information is needed by NRC for assessment of the situation. 586/

584/ Budnitz deposition, Aug. 27, 1979, at 62-63. When asked if the various offices of the NRC operated on a competitive rather than cooperative basis, Robert Budnitz, deputy director of the Office of Regulatory Research, stated, "I could not have phrased is better myself." (Id. at 63).

585/ NRC Staff Report, "Generic Assessment of Feedwater Transients in Pressurized Water Reactors Designed by the Babcock & Wilcox Company" (NUREG-0560, May 1979, hereinafter cited as "NUREG-0560, May 1979"), at 7-1

586,' I&E Mannual, Chapter 1125-041, May 1, 1978.

Once a Bulletin has been issued, it contains two significant sections: a description of the event that provoked the Bulletin, and required "assessments by the licensees as to the need for changes at the plants, and . . . implementation of changes to specific design features or operating procedures at the plants."587/ NRC claims that Bulletins are not issued to licensees until the "draft Bulletins . . . receive adequate technical reviews, including assistance from other I&E technical staffs and other NRC technical groups as needed."588/ However, it appears that NRC of necessity relies very heavily on the nuclear indusry's technical competence in this process.

The first I&E Bulletin issued as a result of the accident at TMI-2 was 79-05, distributed on April 1, 1979. Item 4 of "Actions to be Taken by Licensees" required that operators not override automatic actions of engineered safety features without sufficient cause for doing so.589/ On April 5, 1979, I&E issued another Bulletin 79-05A, which again emphasized that reactor operators must allow the automatic emergency safety systems to function as designed. Specifically, this Bulletin required that "in the event of HPI initiation, with reactor coolant pumps (RCP) operating, <u>at least one RCP [reactor coolant pump] per loop shall remain operating."590/</u>

On April 21, 1979, I&E issued a third TMI-2 related Bulletin 79-05B. This Bulletin emphasized that "the preferred mode of core cooling following a transient or accident is to provide forced flow using reactor coolant pumps."591/

On July 26, 1979, I&E issued two more Bulletins 79-05C and 79-06C. As a result of "a series of meetings between the NRC staff and Westinghouse, as well as with other PWR (pressurized water reactor) vendors, to discuss [the issue of when to terminate operation of reactor coolant pumps (RCP)]," I&E now requires "[u]pon reactor trip and initiation of HPI caused by low reactor coolant system pressure, [that an operator] <u>immediately trip</u> [shut off] <u>all operating RCPs."592/</u> As the basis for this change, I&E stated that

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587/ NUREG-0560, May, 1979, at 7-1.

588/ I&E Manual, Chapter 1125-071(f), May 1978.

589/ Bulletin 79-05, April 1, 1979, at.

590/ Bulletin 79-05A, April 5, 1979, at 3 (emphasis supplied).

591/ Bulletin 79-05B, April 21, 1979, at 1.

592/ Bulletin 79-05C, July 26, 1979, at 2 (emphasis supplied).

> (r]ecent preliminary calculations [performed by the vendors] indicate that, for a certain spectrum of small breaks in the reactor coolant system, continued operation of the RCPs can increase the mass lost through the break and prolong or aggravate the uncovering of the reactor core.593/

Bulletin 79-05C, requiring operators to immediately trip all reactor coolant pumpts after a transient, was issued 4 months after the accident, and more than 3 months after Bulletin 79-05B, April 21, 1979.

The NRC is awaiting further calculations on small-break LOCAs from nuclear steam system vendors, as well as those required from licensees by Bulletin 79-05C, item 2. As a result of these new analyses, it is conceivable that I&E instructions to reactor operators for dealing with these pumps will change once again.594/

593/ Id., at 1 (emphasis supplied).

594/ Gilinsky deposition at 55. Similar developments have occured with respect to yet another requirement contained in post-TMI-2 I&E Bulletins. Bulletin 79-05, issued April 1, 1979, required that B&W licensees "[R]eview the actions requested by the operating procedures and the training instructions to assure that operations do not override automatic actions of engineered safety features without sufficient cause for doing so" (page 2). Four days later, this was modified by I&E Bulletin 79-05A, which advised licensees that during the accident, TMI-2 operators had throttled the high pressure injection system (HPI), despite continuing primary coolant inventory loss through the open PORV, and that this action led to a further reduction of primary coolant inventory (page 1, paragraph 5). Operating procedures were ordered changed to specify that, if HPI has been automatically actuated, it must remain in operations until (1) low pressure injection (LPI) has been established and the situation has been stable for 20 minutes, or (2) HPI has been in operation for 20 minutes and both leg temperatures are well below saturation temperature (page 3, paragraph 4). On April 21, 1979, I&E Bulletin 79-05B was issued to modify 79-05A. The new Bulletin required that the length of time HPI is in operation "shall be limited by the pressure/temperature considerations for the [reactor] vessel integrity" (page 3).

On Sept. 25, 1979, a transient occurred at North Anna Unit No. 1. HPI was initiated, and below saturation temperatures were achieved. (NRR Memorandum, "Transient at North Anna," Oct. 4, 1979, Enclosure 2 at 1). As required by Bulletins 79-05A and 79-05B, HPI was not terminated until it had been in operation for 20 minutes (Id. enclosure at 3.) This increased the pressure in the primary system to the point where the PORV cycled open and closed for 13 minutes (Id., Enclosure 2.) NRC concluded that ". . it is not desirable for this valve (or the safety valves as well) to lift unnecessarily. . ." (Id.) and that "from this transient, it was shown that requiring HPI operation for as long as 20 minutes may not be necessary. . . ." (Id., Enclosure 2 at 1-2.) (Continued on next page.)

E. ENFORCEMENT

Enforcement policy issues from NRC headquarters, but implementation of those policies and the actual inspection of licensee facilities is left to the five regional I&E offices. These offices operate pursuant to guidelines set forth in the periodically updated I&E Manual.

The Manual divides noncompliance with NRC requirements into three categories. The most serious category is "violations."595/ An example of a violation is an exposure of a person to more than five rems of radiation. 596/ The intermediate level of noncompliance is an "infraction"597/ failure to conduct an adequate radiation survey.598/ The third and least serious category of noncompliance is a "deviation"599/ -- failure to maintain a required record.600/

The I&E Manual requires points to be issued for each instance of noncompliance, based upon formulae that take into account the severity of noncompliance and whether the licensee has previous noncompliances on its record. 601/ The formulae leave room for exercise of discretion. A violation such as an excessive exposure would probably warrant 100 points. An infraction worth 10 points could rise to a 40-point violation for a second offense. 602/ The rule of thumb is tha accumulation of 100 points or more triggers consideration of enforcement action, although neither that number of points nor any other requires enforcement.603/

During NRC staff review of proposed B&W emergency guidelines for small breaks, B&W had been asked to reexamine the requirement for a minimum 20 minutes of HPI. "B&W's evaluation concluded that the 20 minutes of HPI operation criterion was not needed and was eliminated from their emergency guidelines." (Id., Enclosure 2 at 2). Westinghouse (the North Anna vendor) and Combustion Engineering emergency procedures under **review**, including their HPI termination criteria. Westinghouse has submitted proposed criteria; NRC staff have not yet concluded whether the proposed criteria would avoid PORV lifting (Id.).

595/ I&E Manual, Sec. 802.04.

596/ Smith, George H. deposition at 15; I&E Manual Sec. 802.05.

597/ I&E Manual, Sec. 802.05.

598/ Smith, George H. deposition at 15; I&E Manual Sec. 802.05.

599/ I&E Manual, Sec. 802.08.

600/ Smith, George H. deposition at 15, 23.

601/ Id. at 16.

602/ Id. at 15-18, 23-25.

603/ Id. at 16.

Decisions concerning criminal proceedings against licensees are left to NRC's Office of Inspector and Auditor.604/

Enforcement remedies authorized by the Atomic Energy Act are:

- Revocation of License. The NRC has authority to revoke an operating license if the licensee has made any "material false statement" in its application or any other false statement in documents, such as the Safety Analysis Report. Moreover, revocation is available if the NRC learns of conditions that would have prevented the granting of an operating license or if the licensee constructs or operates the facility in violation of requirements.605/

- Injunction. Injunctive relief is available to prevent or stop violations of the Act, regulations, or any order issued pursuant to the Act or regulations. The Department of Justice may make judicial application for this relief.606/

- Civil Penalties. The NRC may assess civil monetary penalties for violations of specific statutory licensing requirements, of rules, regulations, and orders issued thereunder, or of license terms. Civil penalties are also available to enforce any violation for which a revocation is possible.607/

Civil penalties are set at a maximum of $5,000 for any single violation. However, no party can be penalized above $25,000 for all violations occurring within a period of 30 consecutive days. Violations are "continuing" -- each day of an ongoing violation is a separate violation for purposes of computing the penalty.608/

604/ Id. at 17-18.

605/ Atomic Energy Act of 1954, P.L. 83-703, (68 Stat 919) Sec. 186(a).

606/ Id., Sec. 232.

607/ Id., Sec. 234.

608/ Id; and 10 CFR Part 21.

o <u>Criminal Penalties.</u> The NRC may seek criminal penalties for willful violations of certain specific statutory sections up to $10,000 in fines, or imprisonment for not more than 10 years, or both, except that commission of such offenses "with intent to injure the United States or with intent to secure an advantage to any foreign nation" can warrant up to $20,000 in fines, life imprisonment, or <u>both.609/</u> Willful violations of other than the specified sections are punishable by fines up to $5,000 or 2 years imprisonment or both; if there is intent to injure the United States or secure advantage for foreign nations, the latter penalties rise to $20,000 or 20 years imprisonment.610/

Once the NRC is informed of a possible violation of its regulations by the licensee, the basic decision to prosecute rests with I&E. While the general procedure calls for "consultation" between I&E and the Office of the Executive Legal Director (OELD) before prosecution begins, it is the exception, not the rule, for the Executive Legal Director to be informed of any prosecution unless a novel legal question or a matter of first impression if involved.611/

In its 1978 Annual Report, NRC describes its enforcement activities as being:

> [D]esigned to assure that licensees perform in accordance with NRC regulations, licenses and permits and with applicable sections of Federal statutes.612/

NRC claims that it is likely to take enforcement action where noncompliances "reflect on the effectiveness of the licensee's inspection program,"613/ rather than where the problem is identified by the licensee's own inspection program, the licensee has adequately corrected the problem, and the noncompliance is insignificant 614/

According to the NCR, its effort to strengthen enforcement is demonstrated by its request to Congress to increase the civil monetary penalties which NRC may impose. If this request is implemented, NRC's maximum allowable penalties will increase to $100,000 for a single

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609/ 1954 Act, supra, Sec. 222.

610/ Id., Sec. 223.

611/ Shapar deposition at 6-7.

612/ 1978 NRC Annual Report at 108.

613/ Id.

614/ Id.

violation, and to $300,000 for all violations committed by a licensee without 30 days.615/ However, in a Feb. 16 report to Congress, the GAO concluded:

> Although NRC believes it needs authority to impose larger civil penalties, it has not made full and effective use of the authority it now has. Specifically:
>
> -- When NRC finds that a licensee has violated a regulatory requirement on separate occasions, or on a continuing basis, it usually cites the licensee for only one violation. This practice reduces civil penalty amounts, and understates the number and frequency of violations found in inspections.
>
> -- NRC is not always aggressive in selecting and imposing civil penalty sanctions consistent with its desired image of a tough but fair regulator.
>
> -- NRC does not always promptly clarify regulations in dispute.
>
> -- NRC takes too much time to select and impose civil penalties. This diminishes their effectiveness.
>
> -- NRC does not notify state utility commissions when it imposes civil penalties on utilities operating nuclear power plants.616/

GAO provided case studies for each finding. It noted that, for over half of the cases reviewed, the licensee had violated the same regulatory requirement more than once since the previous NRC inspection. Yet, in all but one of these cases, NRC cited the licensee for only one violation. This NRC action reduced drastically the possible civil penalty in each case.617/ GAO also found that, in 20 percent of the cases reviewed, NRC treated continuing violations as single rather than separate for the purpose of computing the penalty:

> In one case, a utility did not analyze its reactor's cooling water for radioactive material content for a period of 6 months. NRC required a monthly analysis. NRC treated the licensee's failure to conduct the required analysis as one violation with a civil penalty of $1,000 instead of six violations with a civil penalty of $6,000.618/

615/ Id.

616/ GAO Report, "Higher Penalties Could Deter Violations of Nuclear Regulations," EMD-79-9, Feb. 16, 1979, at 10, 20.

617/ Id. at 10-11.

618/ Id. at 11.

GAO also cited examples of NRC headquarters' downgrading of proposed civil penalties to enforcement letters to licensees, over the objections of the regional inspection offices, and examples of NRC's proposing much smaller civil penalties than its own enforcement policies and procedures called for because of "perceived but unsubstantiated licensee financial hardships."619/

NRC agreed with several of GAO's assessments and said it was taking or considering corrective action as to some of them. However, NRC believed it was effectively using its civil penalty authority. NRC executive director for operations, Lee Gossick, pointed out that all but one of the examples discussed by GAO occurred between late 1974 through the first part of 1977, and did not reflect accurately the present enforcement program.620/

As a result of the NRC response, GAO additionally reviewed the 12 civil penalties imposed by NRC between January and November 1978, and found instances of consolidating violations, untimely processing, and other evidence of unaggressive use of civil penalty authority in 6 of 12 cases.621/

Moreover, no plant's operating license has ever been revoked by the NRC, although the OELD has concluded that such action is within the NRC's authority.622/ Prior to March 13, 1979, only one operating license was ever suspended (Nov. 18, 1977).623/

The relatively light monetary fines imposed by both the AEC and NRC are generally paid by licensees shortly after they are assessed. However, in 10 of 35 penalties imposed upon commercial power licensees, the licensees were successful in reducing the amount of the proposed penalty by an average of several thousands of dollars.624/

619/ Id. at 12, 21.

620/ Id. at 26-29.

621/ Id. at 25.

622/ Shapar deposition at 8, 11-12.

623/ On March 13, four reactors were ordered closed due to seismic design inadequacies. After the accident at TMI, the NRC temporarily closed the remaining B&W reactors. See, Formal Orders of the Commission Requiring Shutdown of Construction or Operation of Part 50 Power Reactor Licenses, Aug. 7, 1979, Office of Executive Legal Director; see also, Shapar deposition at 13.

624/ See, Summaries of Civil Penalties imposed by AEC and NRC, Aug. 3, 1979, from Jim Lieberman, OELD/NRC to the President's Commission. Two of these proposed penalties were reduced by the AEC and eight were reduced by the NRC. See, "Civil Penalty Action" forms for Docket Nos. 50-280; 50-281; 50-269; 50-270; 50-3; 50-247; 50-244; 50-289; 50-309; 50-245; 50-324; 50-333.

The institution of punitive action in Region I, the region with jurisdiction over TMI, has been infrequent. Since October 1978, Region I has issued one civil penalty, although two others are being "processed."625/ Recommendations to NRC headquarters for criminal action are also rare.626/ In this same time period, Region I uncovered "several hundred" noncompliances at the 20-odd reactor sites in the region. 627/ Roughly 90 percent of noncompliances are "settled" simply by the writing of an enforcement letter to the involved licensee and the receipt of a response to that letter.628/

The enforcement process is extremely slow. Noncompliance initially leads to correspondence with the licensee in an attempt to persuade the licensee to comply. 629/ If that process proves fruitless, an "immediate action letter" should follow.630/ However, the usual time between the initial recognition of a noncompliance and the issuance of the immediate action letter is 2 to 3 years.631/

625/ Neither of these involved Three Mile Island. Smith, George deposition at 12.

626/ See Smith, George deposition at 12-13, 17-18.

627/ Id. at 13.

628/ Id.

629/ Donaldson deposition at 60-61.

630/ Id. at 60-61.

631/ Id. at 61.

VII. OPERATOR LICENSING AND TRAINING 632/

The AEC concentrated on containment, engineered safeguards, and other protections against the consequences of a nuclear accident.633/ At the same time, the Naval Reactor Program concentrated on guaranteeing "that the accident would never happen."634/ This approach was the result of a realization that any serious accident would probably kill support for further reactor development work, and that margins of safety for a nuclear powered submarine could not be established in the same way they were for land-based reactors. For example, submarine crews had no avenue of escape while the ship was at sea and major ports were generally near large population areas. Thus, "remote siting" could not be relied upon to limit the consequences of an accident, and containment could not be "reasonably engineered" for a submarine. 635/ For the Naval program, this required not only emphasis on error-free engineering, design, components, and construction, but "totally competent and reliable . . . operating personnel." 636/ The operators were viewed "as the ultimate safety barrier," 637/ and Naval operators were put through careful and rigorous selection and training programs.638/

The NRC inherited the AEC's approach to operator training, which basically left the matter to the utilities. The results of this approach are dramatically illustrated in the context of the TMI-2 accident. One commentator has noted that:

> . . . the specific sequence of mechanical and human events that occurred at Three Mile Island had not been anticipated. Thus, there were no detailed procedures to follow. Emergency decisions had to be made, some of them within seconds. And they were made by reactor operators with limited education (generally a high-school diploma), whose superficial training

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632/ For a complete discussion of operator training, see, R. Etchyison, technical staff analysis report on "Operator Training," prepared for the President's Commission.

633/ See generally Rolph, supra, at 23-24.

634/ Id. at 24.

635/ Id.

636/ Id.

637/ Id. at 26.

638/ Id. See also, Comments by Admiral H. G. Rickover, before the President's Commission (July 23, 1979), at 13-17A.

could not compensate for their lack of a sophisticated understanding of reactor physics and engineering.639/

Section 107 of the Atomic Energy Act of 1974 requires the NRC to:

- prescribe uniform conditions for licensing individuals as operators;
- determine the qualifications of these individuals;
- issue licenses; and
- suspend licenses where appropriate.

Operator licensing is the responsibility of the Operator Licensing Branch (OLB) of the Division of Project Management in the Office of Nuclear Reactor Regulation (NRR). Specific procedures and criteria for the issuance of operator licenses are set forth in 10 CRF Part 55 and NRC Regulatory Guide 1.8.

The Operator Licensing Branch (OLB):

Examines and licenses candidates for reactor operator licenses; develops qualifications and requirements, testing techniques, and standards for evalution of candidates and conducts safety evaluations for design and operation of reactor projects.640/

Yet, OLB is "relatively isolated" from equipment design. 641/ As of March 28, 1979, Paul Collins, Chief of OLB, had eight full-time examiners and 22 part-time examiners to create, administer, and grade operator examinations and process operator requalification matters. Few of the 22 part-time examiners had commercial reactor experience.642/ Most of the 22 part-time examiners are divided into three distinct groups for testing: one group handles Westinghouse; the second,

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639/ Brightsen, supra, at 130; see also, Creswell deposition at 25-28; Denton deposition at 164-165; Ebersole deposition at 61-64; Eisenhut deposition at 100-102; Mattson deposition at 128-129; Michelson deposition at 22-24; Minogue deposition at 50-54; Skovholt deposition at 97-98.

640/ NUREG-0325, U.S. Nuclear Regulatory Commission Functional Organization Charts, January 1979, at 34; Boyd deposition at 85-86.

641/ Collins deposition at 3-4; TMI Commission hearings, Collins testimony, Aug. 22, 1979, at 172, 191.

642/ TMI Commission hearings, Collins testimony, Aug. 22, 1979, at 177. See, technical staff analysis report on "Selection, Training, Qualification, and Licensing of Three Mile Island Reactor Operating Personnel," prepared for the President's Commission.

General Electric; the third handles B&W, Combustion Engineering, and research reactors.643/ Approximately 1,200 operator licenses come up for renewal each year.644/

The NRC has paid little attention to operator licensing and training. According to Harold Denton, Director of NRR,

> . . . [o]perator licensing has been a backwater thing in this organization, sort of divorced from the design analyst sort of thing. It was sort of assumed that any machine that the people could put together - the operators could be trained to operate.645/

NRC Chairman Hendrie has stated that ". . . until recently [he had not] paid a great deal of attention to the operator training side of the NRC activities . . . ."646/ Before August, 1978, NRC Commissioner Ahearne "can't recall the issue of operator qualification or training coming up."647/

Training is left entirely to the utility and the NRC's role is confined to testing and licensing.648/ However, the training programs are not periodically evaluated by NRC. B&W was audited when it was starting up its training program in 1968. No audit has been conducted since then.649/ It is generally acknowledged that training courses "teach the test" administered by the NRC and that the utilities maintain "fraternity files" of prior NRC examinations for use in the course.650/ However, Collins believes that this factor is negated by the oral examination that the NRC also requires applicants to undergo. 651/ Factors pertinent to the TMI-2 accident, such as saturation conditions

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643/ Collins deposition at 41-43; Skovholt deposition at 111-112.

644/ TMI Commission hearing, Collins testimony, Aug. 22, 1979, at 177; Minogue deposition at 51.

645/ Denton deposition at 171-172; Hendrie deposition at 156-157.

646/ Hendrie deposition at 156.

647/ Ahearne deposition at 77.

648/ Skovholt deposition at 54-55; TMI Commission hearing, Collins testimony, Aug. 22, 1979, at 187-192. Commissioner Ahearne believes this is an incorrect approach (Ahearne deposition at 100-101).

649/ Collins deposition at 10-13 60; see also, Eytchison, supra.

650/ Collins deposition at 39; TMI Commission hearings, Collins testimony, Aug. 22, 1979, at 187.

651/ Collins deposition at 38-40.

in the reactor coolant system, small-break LOCAs, and the relationship between pressurizer level and core coolant level, were not covered on NRC examinations .652/

Although NRC requires an applicant for a cold license -- a license issued before the plant begins operations -- to have "extensive actual operating experience at a comparable facility," this requirement can be satisfied by successful completion of the utility's classroom and simulator training program. 653/ The NRC has no requirements that the training course use formal materials for simulator drills. There is no requirement that significant transients are to be incorporated into either classroom or simulator training. The NRC has no requirement for instructor training supervisor qualifications. Finally, the NRC does not monitor classroom attendance at training sessions.654/

In 1973, the AEC issued regulations requiring annual requalification of licensed operators to insure that they were maintaining their skills on a current basis. Each utility's requalification program is periodically audited by the NRC and examination results of the program are spot-checked. 655/ The "spotcheck" consists of looking at six examinations every 2 years.656/ Oral qualification examinations are conducted by the utility and are not monitored by the NRC. There are no specific qualifications for the instructors. The NRC does not audit simulator training and requires no evaluation of simulator performance in the program. A senior operator can satisfy the requalification requirement of simulator maneuvers by simply supervising such maneuvers by another operator.657/

The written requalification examination administered by the utility covers several subjects, two of which specifically focus upon emergency

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652/ TMI Commission hearings, Collins testimony, Aug. 22, 1979, at 182 Skovholt deposition at 83. Bruce Boger, an NRC reactor engineer in OLB, testified that operators were trained not to rely on a single piece of information, such as pressurizer level indications, but were "also taught to believe their instrumentation." Boger acknowledged that this was "Mind of like a catch-22." (Boger deposition at 57.)

653/ Collins deposition at 67.

654/ Collins deposition at 85-88; Skovholt deposition at 69, 73-74, 89-90; see also Eytchison, supra, at B.2.C. TMI Commission hearings, Collins testimony, Aug. 22, 1979, at 176.

655/ Collins deposition at 19-23.

656/ TMI Commission hearings, Collins testimony, Aug. 22, 1979 at 175.

657/ Collins deposition at 25-26, 29-30, 36, 77-78; Skovholt deposition at 70-71; TMI Commission hearings, Collins testimony, Aug. 22, 1979, at 175-77; 10 CFR, Part 55 Appendix A.

procedures-658/ If an operator has an overall score of at least 80 percent, the operator p-sses even if his score is very low on particular parts of the examination, e.g. emergency equipment or emergency procedures. 659/ Moreover, if an operator scores between 70 and 80 percent, he can continue as a licensed operator until he can attend the next regularly scheduled lecture in the specific subject area of his weakness. 660/ About 50 percent of the requalification programs administered by the utilities allow an operator who fails the written examination with a grade below 70 percent to continue as a licensed operator (while he takes "accelerated training") as long as he does well enough on the utility's oral examination, the results of which are not monitored by the NRC.661/

"Cross-licensing" programs are also left to the utilities. If two units (such as TMI-1 and TMI-2) are sufficiently similar (same megawatts, same primary system vendor, same site, etc.), an operator licensed on one unit may be "cross-licensed" for the other unit upon completion of a "differences" course and an examination administered by the utility. No NRC examination is required and the NRC does not audit these examinations. Even substantial differences in the balance of the plant, such as two different designs by two different architect-engineers, will not preclude "cross-licensing" if the primary systems are sufficiently similar.662/

The NRC's treatment of operator training and licensing can be illustrated by two facts:

1. Prior to March 28, 1979, the NRC had no reservations about the B&W training of TMI-2 operators. Indeed, the performance of the TMI-2 operators on NRC examinations was considered "very satisfactory."663/

2. Immediately after the TMI-2 accident, all B&W plants were closed while the operators underwent retraining. This retraining

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658/ The regulation indicates that the requalification examination must test: (a) theory and principles of operations: (b) general and specific plant operation characteristics; (c) plant instrumentation and control systems; (d) plant protection systems; (e) engineered safety systems; (f) normal, abnormal, and emergency operations procedures; (g) radiation control and safety; (h) technical specifications; and (i) applicable portions of the regulation. (10 CFR 55 Appendix A).

659/ TMI Commission hearings, Collins testimony, Aug. 22, 1979, at 175-176.

660/ Id. at 174; Collins deposition at 25-26.

661/ Skovholt deposition at 60-62; Collins deposition at 25-26.

662/ Collins deposition at 68-70; TMI Commission hearings, Collins testimony, Aug. 22, 1979, at 178-179; Boyd deposition at 64; Gallina deposition (Aug. 2, 1979) at 12-13.

663/ Collins deposition at 13-14, 19, 45-46, 49.

consisted of one week at B&W's simulator followed by an examination administered by the utility. The NRC gave an oral examination to a selected number of operators "to form a basis for determining whether or not the licensee's judgment was indeed well founded." 664/ Following the TMI-2 accident, Collins initially recommended that all of these operators be examined by the NRC; however, his recommendation was overruled in favor of "the same path" of spotchecking as before. 665/ Moreover, NRR director, Harold Denton testified that the NRC had not yet made a final decision as to whether it will now look at vendor training programs.666/ "We may well require that . . . the utilit[ies] themselves do far more in testing and demonstrating the capabilit[ies] of their operators prior to our final examination." 667/ The NRC is planning to change the quality of the test,668/ but Denton does not know when or how long it will take to develop a new test.669/ In the interim, NRC has raised the passing grade on the test it had been using prior to TMI-2.670/

On July 30, 1979, Collins submitted a report to the NRC commissioners, which recommended, among other things, that the experience requirements for senior operators be increased; that simulator training be required for "hot" applicants; that NRC "audit" more "closely" the training programs; that more explicit requirements be included in simulator requalification programs; that NRC increase the "level of confidence" in "some" requalification programs; that the scope of license examinations be expanded; that the "passing grade" should be increased; that a training program should be instituted for operator instructors; and that full-time NRC examiners be increased from 9 to 12.671/

664/ Skovholt deposition at 118-119.

665/ TMI Commission hearings, Collins testimony, Aug. 22, 1979, at 183; Commissioner Gilinsky has concluded that it would "indeed be better" had the NRC reexamined all B&W plant operators after the accident. (Gilinsky deposition at 62). Chairman Hendrie, however, has not concluded whether it would be better to test each operator or continue the "audit" practice. (Hendrie deposition at 136-137.)

666/ TMI Commission hearings, Denton testimony, Aug. 23, 1979, at 8.

667/ Id.

668/ Id. at 3.

669/ Id. at 4.

670/ Id. at 3.

671/ "Commissioner Action" Report, from Harold Denton, SECY 79-330E, July 30, 1979, at 2-7.

VIII. NRC EMERGENCY RESPONSE

INTRODUCTION

The Incident Response Program (IRP) was established by the NRC to aid in resolving "incidents involving or affecting NRC licensees."672/ The NRC defines an incident as any occurrence which, by itself or its consequences, poses an actual or potential hazard to public health and safety, property, or the environment; or an actual or potential threat to the safeguards of licensed facilities or materials that requires immediate NRC response. The program's task is to "protect health and safety, the environment, and property from the consequences of incidents which occur as a result of NRC-licensed activities. . .and to assure that the public is kept informed of actual or potential hazards to health and safety arising from such incidents."673/

The IRP has five functions to provide:

- information
- evaluation
- assistance
- direction
- coordination

The IRP consists of the Incident Response Center (IRC) and two NRC groups: the Executive Management Team (EMT) and the Incident Response Action Coordination Team (IRACT). The EMT, which activates the IRC, makes all major decisions affecting NRC actions and it reports directly to the NRC commissioners. The IRACT, on the other hand, is responsible for implementing decisions made by the EMT. During an incident, both of these groups are physically located in the Incident Response Center.

The IRP staff is required to obtain as early as possible the complete facts of the incident and to distribute this information to responsible authorities both within and outside the NRC, as well as to the general public. The EMT is responsible for evaluation of the facts obtained to determine whether the licensee has taken adequate steps to minimize effects on the public health and safety.674/ Technical assistance to the licensee may be offered through the IRP, and the EMT is empowered to direct the licensee to take specific actions it deems necessary based on

672/ NRC Manual, "NRC Incident Response Program," Chapter,0502 (Feb. 6, 1978), at paragraph 01 (Coverage).

673/ Id. at paragraph 02 (Objectives).

674/ Id. at paragraph 022 (Evaluation).

its evaluation of the incident. This can include direct EMT control of a plant through NRC personnel at the site.675/ Finally, the EMT is required to coordinate incident response actions with other federal agencies, including "radiological incident emergency response planning activities."676/

During 1978, NRC completed the specially equipped IRC Center at I&E headquarters in Bethesda, MD.677/ The IRC was designed to improve "the agency's ability to respond promptly to emergency situations."678/ The facility included a conference room, specially designed communications system and audio-visual aids, an operations room for monitoring and evaluating an incident, a communications room, a word processing and computer support area, and a library containing necessary information resources. 679/ In addition, portable communications packages were being developed for use by NRC field personnel, for transmission of information to the regional offices and to NRC headquarters.680/

The IRC was activated during the TMI-2 accident, and NRC field representatives were at the plant site. NRC activities during the accident demonstrate that, as in plant design reviews, NRC conce-trated on equipment rather than on human beings in its emergency response planning. Despite the array of communications equipment, computers, audio-visual devices, and an information library, NRC suffered serious communications problems during the accident; there was no means of systematically evaluating the information received; the IRC, during the accident, was "crowded," "hectic," and was not "big enough for what they wanted to do."681/ NRC's accident response was described as chaotic:

> We could get information and react to it. But the information we were getting back from our people at the site was largely non-discriminatory. They were just telling us whatever was going on. Back in the Incident Center we were having trouble separating the

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675/ Moseley deposition at 110-111; Stello deposition at 104-106.

676/ NRC Manual "NRC Incident Response Program, "Chapter 0502 (Feb. 6, 1978), at paragraph 022 (Evaluation) and 025 (Coordination). The procedures were originally developed between June 1977 and August 1978 by Edward Jordan, then executive officer for operations support and curently assistance Director for technical programs, I&E, with input from NRR and NMSS (Jordon deposition at 52-55).

677/ NRC 1978 Annual Report at 101, 194.

678/ Id. at 102.

679/ Id. at 104.

680/ Id. at 104-106.

681/ Ross deposition at 121. See also, Jordan deposition at 56.

> wheat from the chaff and yelling at that guy to find out what happended here and there. So it was pretty chaotic in retrospect. . . .682/

This was caused, in part, by NRC's failure to provide adequate training to all those NRC officials who would be at the IRC during an event683/ and by blurred lines of authority and ineffective involvement by the NRC commissioners.684/ Indeed, when Harold Denton, director of NRR, considered recommending evacuation due to radiation releases form the plant, he tried to contact the commissioners, but "[a]pparently, they were not available. They couldn't be found."685/ Finally, NRC personnel were required to hastily perform calculations about plant parameters during accident conditions which had not previously been anticipated and planned for -- the course of a multiple-failure accident; accumulation and disposal of hydrogen in the primary system; radiation release monitoring, and emergency planning. As a result, numerous human errors occurred that heightened the confusion and alarm concerning the accident.686/

A. COMMUNICATION PROBLEMS

In the early hours of the accident at TMI-2, the NRC experienced substantial problems with communication between the IRC and the site.687/ Victor Stello, a member of IRACT during the accident, and currently the director of the Office of I&E, stated:

> The original communication system was very poor. We had an arrangement where an engineer sitting here in the operations center was talking to another engineer in Region I who was in turn talking to someone from the site. The communication system was burdened with

682/ Denton deposition at 140. See also, Gibbon deposition at 52-53; Harold Collins deposition at 57-58; Ahearne deposition at 204-205.

683/ Compare NRC 1978 Annual Report at 106 and Thornburg deposition at 115-116, with Ross deposition at 121-122.

684/ Gossick deposition at 145-146; Gibbon deposition at 25, 56; see also, discussion of NRC commissioners' emergency response, Section III.C of this Report, supra.

685/ Denton deposition at 128.

686/ The "Emergency Response" section of this report is not intended to be a detailed discussion of NRC's involvement in the accident. Communication problems and the decision to depressurize the plant's primary system are touched upon as examples of NRC difficulties. Additional discussion is contained in the section of this report dealing with the NRC's commissioners' involvement during the accident, supra. For a detailed discussion of NRC's emergency response, see "Report of the Office of the Chief Counsel to the TMI Commission on Emergency Response."

687/ Jordan deposition at 54.

requests and the need for information of a variety of sources that could bypass the system that we had here saying it in a different way, people could call up Region I and ask Region I directly to try to get information, as well as the engineer sitting here communicating with Region I, so there was a burden on the one link of the communications system, and for some period of time we had lost communications. Communications got very difficult when they had to put on masks and they had to leave the control room to go over to Unit 1 and get back and forth for information, so the ability to get information was strained. It was not very good.688/

As a result of poor communications, the NRC "decided it would be good to send a team up to the site" on Thursday, March 29, 1979.689/ However, communications at the site were no better between the NRC contingent and the plant itself. Richard Vollmer, assistant director for systems and projects, NRR, "was the lead NRC person at the site [until] Denton arrived 690/ He described the method of communication at the site this way:

. ..the communications that existed between my group and the plant site, or Bethesda, were very limited. Because what few phones were available at the observation center, where we spent most of our time, or at the motel, where I had set up a meeting room, it was not easy to communicate, certainly with the control room. And when I was on the site, I had to go to Middletown to make a phone call back to my office, because the phone communications there were.. not too good. The people back in Bethesda knew much more at that time than we did even though we were there.691/

As a result, sending the team to the site did not greatly improve communication of information to Bethesda. According to Harold Denton:

I had sent a team of people up Thursday [on March 29, including Vollmer], and ... they fell into an Einsteinian black hole. It was practically impossible to get good information from the site.... My recollection... is we would get information after the fact, and then in the course of trying to figure it out, something else would have happened. And we were always sort of chasing the problem rather than being in front of it.692/

688/ Stello deposition at 74-75. Communications were also "bad between both the Response Center and [the commissioners' offices on] H Street and the site," due in part to deficient planning. (Gibbon deposition at 7).

689/ Vollmer deposition at 7-8.

690/ Id. at 18.

691/ Id. at 11-12

692/ TMI Commission hearings, Denton testimony, May 31, 1979, at 305.

Communication problems at Bethesda continued on Friday, March 30, when Harold Denton arrived at the site to take charge for the agency:

> [There were] a whole variety of reactions to this information, but I think the point here is that the information was coming in from a lot of different sources and via a lot of different tracks. There wasn't really any good way to relate one piece of information to another piece of information. I think this is what painted a great deal of the confusion which seemed to reign from time to time over there ... and a lot of people in the Center felt especially on Friday morning that they weren't really convinced that the people on-site had a handle on what was going on that they didn't feel they in the Center had a handle on what was going on.693/

These communication problems reached a high point on Friday morning when the NRC senior staff recommended to the staff, on the basis of fragmentary and partially erroneous information, that an evacuation be undertaken downwind of the plant to a distance of ten miles. That recommendation, which was not implemented, put the NRC commissioners themselves into the management of the accident.694/

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693 Collins deposition at 57.

694/ For a detailed treatment of this phase of the accident, see "Report of the Office of Chief Counsel on Emergency Response," prepared for the President's Commission.

In an attempt to eliminate these communication problems in the future, the NRC installed direct telephone lines between the IRC and the control rooms of all reactors in the country on June 1, 1979.695/

B. RAPID DEPRESSURIZATION

Another example of the problems experienced by the NRC during the accident was a great deal of confusion over the decision to rapidly depressurize the primary system at TMI-2, some 7-1/2 hours after the accident began. During normal operating conditions, this procedure would be proper while bringing the reactor to a cold shutdown or stable condition. 696/ But these were not ordinary operating conditions. The utility was attempting this maneuver to "remedy the problem of voiding in the cooling system,"' by forcing the bubbles out of the core inventory.697

When first informed on Wednesday, March 28, 1979, of the proposed rapid depressurization, NRC personnel considered it an acceptable

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695/ Jordan deposition at 56; **See** also Sept. 28, 1979 letter from George Gowers, NRC, to the President's Commission.

A problem in the operation of these direct telephone lines during an incident occurred on Sept. 25, 1979. At 6:13 a.m., North Anna Unit No. 1 at Mineral, Va., operated by Virginia Electric and Power Company (VEPCO), experienced both a reactor and turbine trip with consequent safety injection actuation. Some radioactivity was released to the containment and the auxiliary building. (See Preliminary Notification of Event of Unusual Occurence, PNO-II-79-1, Sept. 25, 1979).

When the transient began, the NRC duty officer was making his routine reactor facility status check and was speaking with the North Anna control room on the direct line. The following conversation took place:

NRC DUTY OFFICER: NRC Operations Center, what is your status?
VEPCO: We just tripped.
NRC DUTY OFFICER: Just tripped?
VEPCO: Yes.
NRC DUTY OFFICER: You have no idea why?
VEPCO: No it was a turbine trip and ahh we just safety injected.
NRC DUTY OFFICER: OX, that's fine. Thank you.

The NRC has stated that the duty officer did not recall the statement regarding safety injection, and that, upon replaying the tape of the conversation, the statement about safety injection was less audible than the rest of the conversation. See, Sept. 27, 1979, note from Edson Case, NRC, to Stanley Gorinson, President's Commission, Enclosure 2, at 2.

696/ Stello deposition at 99; Eisenhut deposition at 44; Moseley deposition at 111-113.

697/ Eisenhut deposition at 42-44.

option. 698/ Indeed, when this question arose, Norman Moseley, director of the NRC's Incident Response Action Communications Team (IRACT), "...didn't really have any doubts that [rapid depressurization] was an appropriate thing to do."699/ However, had rapid depressurization been completed, it could have substantially aggravated the accident conditions.700/

The temperature of the core cladding is necessary to determine the effects of depressurization. 701/ Very high temperatures would indicate at least partial core uncovery, and depressurization of the system under such circumstances would allow voids in the system to expand, further uncovering the core.702 / Yet, prior to concluding that depressurization should be attempted, neither the NRC nor the utility had obtained computer readouts on core temperatures because none were available. The computer had not been programmed to give readings beyond normal operating temperatures (700°F), because higher temperatures were not anticipated.703/ The computer was not considered safety-related 704/ and it "was not installed to be used in monitoring accident situations."705/

Sometime on Wednesday, March 28, one of the utility's technicians bypassed the computer, put an amplifier directly on the core thermocouple wires themselves, and obtained readings in excess of 2,000°F over a significant portion of the core.706/ However, this information did

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698/ Stello deposition at 100; Moseley deposition at 114; Eisenhut deposition at 43-46; Grier deposition at 106-107.

699/ Moseley deposition at 111-114, 121; Stello deposition at 106-107; Denton deposition at 91.

700/ Levine deposition, Aug. 8, 1979, at 43-45; Moseley deposition at 115-116.

701/ Levine deposition, Aug. 8, 1979, at 45; Eisenhut deposition at 47-50.

702/ Eisenhut deposition at 49, 53.

703/ Grier deposition at 108-109.

704/ Silver deposition at 137; Thadani deposition at 126.

705/ Moseley deposition at 118. Computer temperature readouts were limited to 700°F by the particular program being used, although in-core thermocouple capacity far exceeds this level, as did the actual temperatures at TMI-2. (See Moseley deposition at 118; Eisenhut deposition at 49-50; Grier deposition at 108-109; Hanauer deposition at 33-39). Furthermore, the licensee decides what maximum temperature reading is to be programmed into the computer. (Skovholt deposition at 51-52.)

706/ Oversight Hearings before the Subcommittee on Energy and the Environment of the Committee on the Interior and Insular Affairs, House of Representatives, Serial No. 96-8, Part I, May 9, 1979, at 14-15; Stello deposition at 77.

not find its way to NRC in Bethesda at the time the depressurization decision was made.707/

Similarly, NRC did not know, at the time of the decision, the amount and kind of noncondensable gas in the core,708/ the amount of super-heat present,709/ "the fact that the high pressure injection had been turned off early," 710/ or the level of coolant in the core711/ -- all of which would have indicated the inappropriateness of depressurization.

Now in possession of the pertinent information regarding temperature, interruption of HPI, and the presence of noncondensible gas, the same NRC personnel who supported the depressurization decision uniformly agree that it was not the proper action under the circumstances.712/

707/ Oversight hearings, supra; Stello deposition at 77. The utility, according to ope NRC staffer, did not believe the thermocouple readings taken directly. Eisenhut deposition at 49-50. See also, Moseley deposition at 117.

708/ Eisenhut deposition at 47-48; Moseley deposition at 121.

709/ Moseley deposition at 121.

710/ Eisenhut deposition at 48.

711/ Id. at 54. No devices were in place directly measure core coolant level. Eisenhut, the acting director of the Division of Operating Reactors, testified that "there is [an] available technology [to measure core coolant levels in PWRs]"; such technology is used in boiling water reactors (BWR). Eisenhut deposition at 54-55.

712/ Stello deposition at 107-108; Moseley deposition at 115. See also, Eisenhut deposition at 47-48; Denton deposition at 91-92; Gossick deposition at 133; Silver deposition at 138-139. The utility had partially depressurized the system, in part by reducing HPI to a minimum. But the pressure would not drop below 440 psig. The utility then abandoned the attempt to depressurize when it was recognized that the temperature was to high and that without HPI, there would be no effective means to cool down the system. NUREG 0600, at 1-3-10 to 1-3-13. See also, Moseley deposition at 115; Budnitz deposition, Aug. 1, 1979, at 61; Eisenhut deposition at 46-47.

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