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UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D. C. 20555

INFORMATION REPORT

To: The Commissioners

From: James R. Shea, Director Office of International Programs

Thru: Executive Director for Operations TAR L.U.G.

- Subject: REPORTS GENERATED AND ACTIONS INITIATED BY OTHER COUNTRIES SUBSEQUENT TO THE TMI-2 INCIDENT
- <u>Purpose</u>: To advise the Commission and senior staff of actions initiated and reports prepared by foreign countries in the wake of TMI-2.
- Discussion: As the Commission is aware, several countries (Japan, France, Sweden, the FRG, Korea, Switzerland, Italy, Brazil, Denmark, Spain, the UK, Canada, Israel, Taiwan, Belgium, the Netherlands, Israel, and Argentina) and three international organizations (the EC, the IAEA, and the International Institute of Applied Systems Analysis) have sent special delegations to the U.S. to learn, first-hand, about the TMI-2 incident. Other countries have chosen to be fully represented by their Embassies and long-term assignees to the NRC staff (Australia, Ireland, South Africa, Austria, Finland, India, Mexico, Turkey, and the Philippines). IP has provided all such visitors and representatives with copies of available TMI-related reports and documents. In doing so, we have asked that the recipient countries advise us of all regulatory actions which they initiate because of TMI, and send copies of reports generated to analyze the incident.

The enclosure summarizes actions taken by and reports received from several of those countries and international organizations which have followed NRC's TMI-2 activities closely.

Rould Hauber

James R. Shea, Director
 Office of International Programs

Enclosure: As stated

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Enclosure

CANADA

Actions Taken

The AECB, on April 6, 1979, requested all appropriate licensees to conduct a design review of CANDU reactors of the pressurized heavy water type on the basis of TMI events as then known. The key points to be assessed included (a) reliability of steam generator feed water supplies, (b) availability of back-up cooling systems, and (c) adequacy of routine and emergency operating procedures.

On May 23, 1979, the AECB announced its preliminary conclusion that there are grounds for confidence in the safety of all Canadian plants because of the "high degree of protection" afforded by the "design characteristics of CANDU plants and their established operating procedures." The specific licensee reports supporting this preliminary conclusion are listed in the "Documents Received" section.

The AECB has requested further information for its ongoing evaluation process, however. These items fall into four general categories:

- Assurance that unambiguous instructions have been given to operations staff in a number of identified areas.
- Review of operating occurrences to ensure that any changes which were indicated as necessary have been implemented.
- Additional review of the effectiveness of available alternate heat sinks (heat removal systems).
- For plants under construction, an evaluation of the ability to test alternate heat sinks.

IP-Initiated Action

IP has requested additional information on the 1977 NPD nuclear station incident which has received so much Canadian press notice in the past few weeks. The incident has gained prominence as a result of AECB assurances of CANDU safety in light of TMI.

Documents Received

"Preliminary Evaluation of the Safety Features of Bruce Nuclear Generating Station (N.G.S.) 'A' Relative to the TMI Accident," May 1979, 13 pages.

"Preliminary Evaluation of the Safety Features of Bruce N.G.S. 'B' Relative to the TMI Accident," May 1979, 14 pages.

"Preliminary Evaluation of the Safety Features of Pickering N.G.S. 'A' Relative to the TMI Accident," May 1979, 14 pages.

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"Preliminary Evaluation of the Safety Features of Pickering N.G.S. 'B' Relative to the TMI Accident," May 1979, 14 pages.

"Preliminary Evaluation of the Safety Features of NPD Relative to the TMI Accident," May 1979, 13 pages.

"Preliminary Evaluation of the Safety Features of Douglas Point N.G.S. Relative to the Three Mile Island Accident," April 21, 1979, 12 pages.

"Preliminary Evaluation of the Safety Features of Gentilly-2 Relative to the TMI Accident," May 1979, 18 pages.

"Preliminary Evaluation of the Safety Features of Point Lepreau Relative to the TMI Accident," May 1979, 19 pages.

"Notes on the Relevance of the TMI Accident to the CANDU Reactor Design," April 18, 1979, 6 pages.

This report, prepared by AECL asserts that certain CANDU features would prevent the kind of accident that happened at TMI. The following differences from TMI were considered especially noteworthy:

- CANDU steam generators internally store a large reserve of water which is available for cooling should the normal water supply be temporarily lost.
- CANDU plants, in addition to the main system supplying water to the steam generators, provide alternative means should the main pumps fail.
- CANDU plants have a shutdown cooling system which can be valved directly into the reactor cooling system, thereby incorporating a further line of defense for the removal of reactor heat.

DENMARK

Document Received

"Report on the TMI Incident in Harrisburg, Pennsylvania," May 1979. Being translated.

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Actions Taken

The Commission of the European Communities, in the wake of the TMI incident, has decided to appoint three high-level, independent experts to monitor protection measures in the 9 Member States so that the best methods can be made known to all. These experts, who have yet to be named, will also promote better training-for personnel working at nuclear installations, as well as more research into nuclear security.

Document Received

"Report on the Accident at the TMI Nuclear Power Station," May 4, 1979, 17 pages. Available in English.

This report on the incident and associated events was based on preliminary written and oral information supplied by the NRC staff. The EC acknowledges its provisional nature and warns that its conclusions should be reviewed when the ongoing detailed analyses are completed.

FINLAND

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Documents Received

"Account of the TMI Incident," prepared by the Institute of Radiation Protection, April 9, 1979. Being translated.

9 short implication assessment reports from the Institute of Radiation Protection.

FRANCE

Actions Taken

The French safety authorities have organized a task force to study the TMI accident, and to draw conclusions on the safety of French PWRs. In addition to representatives of the French safety authorities (Central Safety Service for Nuclear Installations, S.C.S.I.N.), and their technical consultant (Department of Nuclear Safety), the task force consists of the operator EdF, and the designer Framatome.

- Objectives final conclusions by the S.C.S.I.N. based on the findings of the task force;
 - requirements on the operator EdF to re-analyze plant safety in light of the lessons learned from the TMI accident;
 - improvements in plant surveillance by nuclear plant
 inspectors.

An initial series of requirements was prepared and forwarded to EdF by letter on April 18, 1979. These requirements consider plant design differences and differing requirements established in the course of plant licensing.

1. <u>Pressurizer relief valves</u>: EdF will provide S.C.S.I.N. within one month a synthesis of qualification test results for these valves, and an account of incidents with these valves in tests or during operation in 900 MWe plants.

2. <u>Pressurizer level measurement</u>: For 900 MWe plants of the first multiannual contract (built after Fessenheim and Bugey), initiation of safety injection is automatic on a low primary pressure signal without the need for coincidence with a low pressurizer level signal. It is not the same at Fessenheim and Bugey, but the operators are instructed to activate safety injection immediately on low primary pressure alone.

EdF will provide S.C.S.I.N. within one month ·a report describing the means by which Fessenheim and Bugey could be retrofit to the design of plants of the first multiannual contract.

3. <u>Containment isolation</u>: For all 900 MWe plants, containment isolation occurs at the same time as safety injection. This is tested by monthly verification tests.

EdF will transmit an account of difficulties that have been encountered up to the present during these tests.

- To consider the other three anomalies detected at TMI:
 - closure of the steam generator auxiliary feedwater valves
 - manual interruption of safety injection
 - trip of the primary pumps

FRANCE

EdF has been requested to provide an accounting within one month of actions taken after re-examination of their operator and quality control procedures. To be reviewed specifically:

- technical specifications with respect to availability of safety systems and their auxiliaries (test procedures and maintenance, information on operational equipment, description of systematic inspections. . .);
- procedures to be followed in case of an incident, and more particularly, for the initiation of safety actions.

In addition:

 Auxiliary building ventilation system outlet filters: EdF will study the control and automatic actions of these filters.

In the meantime, EdF will immediately install permanent filters at Bugey, as they are at Fessenheim.

6. EdF will provide within one month a description of actions taken after re-examination of the following:

- conditions for starting of the auxiliary feedwater pumps, and experience acquired from tests and from operation in French plants;
- conditions for operating (notably in the radiological protection plan) and testing equipment to be used for hydrogen recombination;
- the capacity (volume and radiological protection) of available tanks at the site to hold contaminated effluents, possibly long term, from an accident involving core damage.

Documents Received

From the CEA's Service Central de Surete des Installations Nucleaires, a 3-volume (summary, report, and annex) document entitled: <u>Report of the Cayol-</u> <u>Roche April 1-6, 1979 Mission to the States on the TMI Accident</u>. Available in English. Summary--4 pages; Report--36 pages; Annex--All material distributed by IP 3/28 to 4/6/79.

This document, acknowledged to be preliminary, is a summary and interpretation of data given to the French team during the first two weeks of the emergency. Its primary focus is on the sequence of events during the early hours of the accident. We understand that the Government is publishing it to reassure the French public that it is following TMI closely and being forthcoming with any conclusions reached.

"Answers of Industry Minister Andre Giraud to TMI Questions of Senator Charty," April 24, 1979. Being translated.

Document Received

Accident at America's TMI Nuclear Power Plant: A Collection of Preliminary Materials, Information and Conclusions, prepared by the BMI, May 1979. Being translated.

This report, presented by the Minister of Interior to the Interior Council of the FRG Parliament, contains a compendium of TMI material available through April 5, 1979.

Document En Route

The Second Interim Report of the BMI to the Interior Council of the FRG Parliament, May 1979.

The BMI has advised IP that this document, recently forwarded, contains a list of measures already introduced or in the process of being introduced in FRG nuclear facilities, as a direct result of TMI.

ITALY

Actions Taken

The CNEN, in early May, ordered ENEL, the sole Italian licensee, to immediately carry out the following actions:

- Review plant operating instructions, with particular reference to emergency situations arising from operational occurrences, for all nuclear facilities with current operating licenses, with licenses applied for, or with licenses being revised. In addition, properly instruct operational personnel in responding to unsafe plant conditions.
- For the Trino Vercellese PWR, assure that the emergency water injection into the reactor coolant system occurs when the pressurizer pressure reaches the low setpoint, regardless of the pressurizer level.

The Director of the CNEN Safety and Reliability Protection Division, on May 8, also appointed a Working Group to evaluate all possible implications of the TMI incident to Italian facilities, and to make recommendations on future actions and corrective measures. The Group was asked to submit its first draft by June 20.

Finally, the CNEN is collecting additional information on the technical and organizational aspects of the emergency response in the area immediately surrounding TMI. It will probably recommend a review of the emergency plans for all Italian nuclear power plants, following its analysis of the data.

Documents Received

"Problems Connected with the Emergency Response Organization," notes taken by G.C. Boeri and A. Morici of the CNEN during H. E. Collins' April 6 briefing in Bethesda. 8 pages. Available in Italian.

"Preliminary Information Report on the March 28 TMI-2 Accident," a report prepared by G. Petrangeli for the CNEN Technical Commission, May 1979. 11 pages. Available in Italian.

"Analysis of the TMI Incident through the Data Available Up to April 20, 1979. Part 1 - Evolution in the Primary Circuit up to Hour 3 of the Incident," a report prepared by the Thermohydraulics and Neutronics Service of the CNEN Division of Safety and Radiation Protection, April 20, 1979. 8 pages. Available in Italian.

JAPAN

Actions Taken

The Japanese announced on April 14, 1979, that they were shutting down Ohi-1, the only PWR in operation in Japan at that time, pending completion of their study of the effects of the identified B&W pressurizer level indicator problem on the function and performance of Westinghouse ECC systems. Kansai submitted reviews of ECCS, management, and the operational adequacy of Ohi-1 and -2, which were approved by MITI and NSC on May 19. Then Ohi-1 was permitted by Fukui Prefecture to resume operation on June 13, and Ohi-2, on June 18, to complete commissioning procedures going from 75 percent to full power operation. All BWRs not already down for scheduled maintenance have continued in normal operation.

Documents Received

"Nuclear Energy News Special," Japan Nuclear Energy Culture Promotion Foundation, April 13, May 1, and May 28, 1979.

The May 1 issue contains the following comparison between Japan's PWR and TMI-2's basic structure and design (informal translation):

- In Japan, in the event the water level decreases in the steam generator, there is an automatic shut-off of the turbine and reactor by the signal that the water level is low, before the signal that the water pressure in the primary cooling system is high. Accordingly, the reactor shuts off in a shorter time, differing from the type of reactor that scrams when the pressure in the primary cooling water gets high, minimizing the rate of rise in temperature. (In an incident similar to TMI, Japan's reactor would scram about 10 seconds faster than TMI's.)
- 2. Japan would make sure that more than 2 auxiliary feedwater pumps are capable of functioning before the start-up of the reactor. If a malfunction occurs in the primary feedwater system, it is inspected immediately and the auxiliary feedwater pump would function automatically. Even if the valve were closed, it would be opened with the automatic-motion signal for the water to flow. It is considered unlikely for all feedwater to stop because auxiliary feedwater systems work independently of each other. Regarding the auxiliary feedwater pump outlet manual valve, it is Japanese practice to lock a handle in order to avoid mishandling, and to use charts and checks during a shift to make sure that the condition of the valve for opening and closing is in order.
- 3. In Japan, regular inspections are carried out before and after operation to determine if the pressurizer relief valves are of high reliability for the operation. Also, pressurizer relief valves are designed to close automatically by an air-operated system, and their condition is monitored in the central control room. In the event a problem occurs, the main valve

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(electric-operated) can be closed in the distant central control room as well, since it is designed to be operable until the relief valve can recover its function. Therefore, it is impossible for it to remain in the open position for more than 2 hours, as was the case at TMI.

- 4. TMI's steam generator is a straight flow type and contains about 50 tons of water in the secondary side. Japan's, however, are U-shaped with about 200 tons of water that will not decrease capability for cooling, even if the water level decreased at a rapid rate.
- 5. The operator stopped ECCS too soon at TMI. In Japan, a high pressure injection system activated after ECCS would have remained in operation, after due consideration to the general conditions of temperature, pressure and water levels of the primary cooling system.
- 6. At TMI, the sump water in the containment flowed to the auxiliary building, resulting in radiation leakage. In Japan, once the ECCS is functioning, two containment isolation valves would operate automatically so as to prevent any water passage until the valves are manually opened. (At TMI, 5 hours after the pressure in the reactor had risen, the isolation valves were activated for the first time, which led to a large amount of primary cooling water flowing to the auxiliary building.)
- 7. The primary coolant pumps, steam generators and other principal components of Japanese reactors are located at a higher level than the bottom of the containment. Therefore, even if all the water of an ECCS flows into the containment, it will not flood the components.
- Reactors in Japan are designed with the natural surroundings in mind, resulting in the capability of maintaining effective cooling even if the primary cooling system is stopped.
- 9. In relation to the possibility of malfunction of the water gauge in the pressurizer, the ECCS operational function differs between the PWR's of B&W and Westinghouse. For example, the Westinghouse PWR is designed for ECCS to activate when the pressure and water level together decrease. (At TMI-2, ECCS activated when pressure registered a decrease.) Therefore, accidents like TMI seem impossible to happen in Japan. A thorough analysis is underway, however, to study the response if a similar accident should occur.

"Inspection Report on Ohi Nuclear Power Plant by the Nuclear Safety Commission, May 24, 1979." Being translated.

THE PHILIPPINES

Actions Taken

The Philippine Government, on June 15, 1979, suspended construction of the Bagac Nuclear Power Plant, scheduled for completion in 1982, " in view of the accident at a nuclear plant near Harrisburg, Pennsylvania, last March." It further threatened to cancel its contract with Westinghouse unless satisfied, after the full inquiry it plans to launch, that there has been no "violation of the warranty of implied safety."

SWEDEN

Actions Taken

The Swedish Government, in April 1979, ordered that the Ringhals-2 PWR, shut down since March 2, 1979, because of steam generator leaks, not resume operation until the following measures are taken:

- Introduction of exhaust facilities for evacuation of a possible gas bubble in the reactor tank.
- 2. Introduction of improved leakage detection.
- 3. Introduction of TV-monitoring in the reactor enclosures.
- Introduction of situation indication on all valves connected with the pressure containment tanks and indication on fractured sheet metal of blow-down tanks.
- 5. Introduction of a system for sampling and analysis of hydrogen gas concentrations in reactor enclosures.
- Analysis of what possibilities exist to connect recombinations for control of hydrogen gas concentrations in the reactor enclosures.
- Supervision of operational disturbance instructions.
- Analysis of possibilities for indicating the water level in the reactor tanks.

All proposed modifications to meet these requirements must be approved in advance by the Swedish Nuclear Power Inspectorate.

Ringhals-3, previously scheduled for fuel loading later this year, is subject to the same orders, as well as to approval by the public referendum on nuclear power, now planned for spring 1980.

Document Received

Evaluation of the TMI Nuclear Accident at Harrisburg, Pennsylvania, from the Perspective of Changes in Procedures for Swedish Power Reactors, prepared by SKI, May 1979. Being translated.

SWITZERLAND

Document Received

"Accident at the U.S. TMI Nuclear Power Plant in Harrisburg on March 28, 1979," dated May 8, 1979. Being translated.

This is an interim report, prepared for the Government by the Nuclear Safety Division of the Federal Office of Energy. It examines the main issues involved with TMI, makes comparisons with Swiss plants, and recommends some safety measures to be initiated in Swiss plants to avoid a similar occurrence.

Comment Received

The Central Electricity Generating Board has been actively pursuing the option of building a PWR in the UK. They advised IP on May 30 that they "feel reassured that the accident has not exposed any fundamental weakness of the PWR system, but rather that it escalated to severe core damage from a series of detail deficiencies which have been well described." They also stated that the "broader issues of coordination of offsite activities, the handling of public relations and evacuation of local communities, and the problems of communication during the accident" had provided them with valuable information for reviewing the effectiveness of their own emergency plans.

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