

December 30, 1977

Title: Ice Effects on Safety-Related Water Supplies - Task B-32
Lead Responsibility: Division of Site Safety and Environmental Analysis
Lead Branch Chief: Lewis G. Hulman, Chief
Hydrology - Meteorology Branch
Task Manager: Frederick J. Hebdon, Project Manager
Environmental Projects Branch 1

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1. Problem Description

Additional information is needed by the staff concerning the potential effect of extreme cold weather and ice buildup on the reliability of various plant water supplies. Of particular concern are phenomenon that could impact the proper operation of safety-related systems (e.g., the Ultimate Heat Sink) and thereby impair the stations ability to shutdown the plant and provide adequate core cooling.

Experience gained during the severe weather conditions that existed during the past winter indicated that a more thorough understanding of the potential effects of severe ice conditions is necessary to ensure that design and operation of safety-related water supplies will ensure adequate operation of the systems.

2. Planned Staff Approach

- a. During the past winter, plants located in the north experienced some difficulties associated with icing of various plant water systems. Although safety-related functions were not impaired, numerous problems such as frazil ice clogging of intake screens, excessive circulating water system ΔT 's, and in some cases reductions in power, due to decreases in normal operation of cooling water supply, were experienced.
- b. The resolution of this task will incorporate as many as four phases.

Phase I: A literature search to identify past instances of ice effects on intake structures for cooling water systems, ice effects on large cooling tower facilities, effects of circulating extremely cold water (e.g., salt water at $<32^{\circ}\text{F}$) thru cooling water systems and any other effects on large industrial facilities caused by icing associated with extreme cold weather.

Phase II: Review by the staff of identified incidents to determine the applicability to safety-related systems of nuclear power plants and fuel processing facilities.

Phase III: Collect the state-of-the-art knowledge concerning the causes and affects of icing phenomenon determined to pose a threat to safety-related systems.

Phase IV: Development by the staff of new Regulatory Guides and changes in the Standard Format and Standard Review Plans, if needed, to incorporate additional review factors required to ensure that icing conditions associated with extreme cold weather will not inhibit the proper operation of safety-related systems.

The Task may be terminated at any point after Phase I if it is determined that existing review criteria are adequate to ensure that potential ice conditions will not inhibit the proper operation of safety-related structures.

c. Description of the End Product

- (1) Revision, if necessary, of various Standard Review Plans to ensure the adequate consideration of severe ice conditions.
- (2) Recommendations for revision, if necessary, of Regulatory Guide 1.70, Standard Format and Content of Safety Analysis Report for Nuclear Power Plants.
- (3) Recommendation, if necessary, for a Regulatory Guide to describe acceptable procedures for assessing ice effects on safety-related systems.
- (4) Development, if necessary, of a NUREG document describing the staff's position concerning the potential effect of severe ice conditions on safety-related systems.

3. NRR Technical Organizations Involved

- a. Environmental Projects Branch 1 (DSE) - provide a Task Manager to serve in the principle management function for the project. (Manpower requirements: FY-78, 1 MM*; FY-79, 1 MM*).
- b. Hydrology-Meteorology Branch (DSE) - provide technical support to assess the significance and applicability of identified icing phenomenon to safety-related water supplies. Assist in the development of additional review criteria, if required. (Manpower requirements: FY-78, 1 MM*; FY-79, 3 MM*).
- c. Auxiliary Systems Branch (DSS) - provide technical support to assess the significance of potential effects associated with ice conditions and their significance. Assist in the development of additional review criteria, if required. (Manpower requirements: FY-78, 1 MM*; FY-79, 3 MM*).
- d. Division of Operating Reactors (DOR) - provide technical support to assess the significance of past operating histories and abnormal occurrences with regard to ice-induced operating and safety-related effects. (Manpower requirements: FY-78, 1 MM*; FY-79, 1 MM*).

*It should be recognized that manpower requirements could vary significantly based on the findings of each Phase.

4. Technical Assistance Funds and Confirmatory Research Funding Required

The FY-78 budget contains a \$15,000 allocation to support Phase I of this project. It is currently expected that this work will be done by the U.S. Army, Corps of Engineers, Cold Regions Research and Engineering Laboratory. Additional technical assistance funding may be required in FY-79 to conduct Phase III.

5. Interaction with Outside Organization

It may prove advantageous for the Staff to contact licensees and operators of other large industrial facilities to obtain additional information concerning ice related problems that have occurred in the past.

6. Assistance Requirements from Other NRC Offices

Office of Standards Development - assist in the development or revision of Regulatory Guides as required.

7. Schedule for Problem Resolution

	Months	Date
a. Issue Contract for literature review [EPM, HMB]	0	March 1, 1978
b. Receive results of literature review (Phase I) [EPM]	3	June 1, 1978
c. Assess applicability of historical events identified by literature search* (Phase II) [EPM, HMB, ASB, DOR]	4	October 1, 1978
d. Issue contract to assess causes and effects of applicable scenarios [EPM]	1	November 1, 1978
e. Receive results of assessment of cause causes and effects of applicable scenarios (Phase III) [EPM]	3	February 2, 1979

*This task could be terminated at any time after this event if it is determined that more detailed assessment of the problem is not required. ACRS will be notified.

	Months	Date
f. Develop staff positions concerning potentially significant events (Phase IV) [EPM, HMB, ASB, DOR]	3	May 1, 1978
g. In-house review of branch position [EPM, HMB, ASB]	2	July 1, 1978
h. Review of position by RRRC and ACRS [EPM, HMB, ASB]	2	September 1, 1978
i. Recommendation for Regulatory Guide forwarded to Office of Standards Development [EPM, HMB]	1	October 1, 1978

8. Potential Problems

Auxiliary Systems Branch (DSS) has indicated that the manpower requirements described in Section 3c may not be available when and if it is needed.

1742 355