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

AEOD/E112

JUN 15 1981

MEMORANDUM FOR: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

50-368

Victor Stello, Jr., Director
Office of Inspection and Enforcement

FROM: Carlyle Michelson, Director
Office for Analysis and Evaluation
of Operational Data

SUBJECT: INOPERABILITY OF INSTRUMENTATION DUE TO EXTREME COLD WEATHER

Reference: IE Bulletin 79-24, Frozen Lines, dated September 27, 1979

As a result of a recent occurrence at Arkansas Nuclear One (ANO) Unit 2 where all four channels of refueling water storage tank (RWST) level instrumentation were inoperable due to frozen transmitters, this office has conducted a search of Licensee Event Reports (LERs) to determine if any trends or patterns could be discerned from similar occurrences.

The event at ANO-2, however, is particularly significant since the Combustion Engineering reactors utilize the RWST level to initiate automatic transfer of the ECCS pumps from the RWST to the containment sump after a LOCA. This is accomplished in the following manner: when the RWST level reaches approximately 10%, a "Recirculation Actuation Signal" (RAS) is generated by two-out-of-four coincidence logic. The RAS is used to close the RWST discharge valves and open the containment sump valves, thereby transferring suction of the ECCS pumps to the containment sump. The RAS is also used to stop the low pressure safety injection pumps and to secure the ECCS pump mini-flow back to the RWST. Therefore, in the highly unlikely instance that a large break LOCA occurred during the time that the four RWST level instruments were frozen there is a possibility that the safety injection and containment spray pumps would have been run dry unless the operators acted quickly to remote-manually open the containment sump valves. Assuming all the safety injection pumps and containment spray pumps are running at their run out flows as they would be following a large break LOCA, the operators would have about three to five minutes to open the containment sump valves from the time the RWST level reached 10% before the tank was pumped dry. Even though the RWST low-level alarm would not be provided in the control room when all four level channels are inoperable, this is probably sufficient time since one of the main things operators would be watching for about 15 minutes into the transient is the transfer of ECCS suction. In fact, it is extremely likely that alert operators would notice the hangup of the RWST level indication much earlier in the event and take appropriate action.

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In other plant designs, however, the containment sump valves are interlocked with the RWST level and require a low-level permissive before the valves can be remote-manually opened from the control room. Further, if as in the above example, all level channels were inoperable, an operator may have to go outside the control room to override permissives in order to open the containment sump valves. The operator would be required to verify RWST level prior to overriding the interlocks and opening the sump valves.

Based on the data obtained from the LER search, most of the occurrences of loss of RWST/BWST level instrumentation due to freezing involved only a subset of the available channels. Therefore, the low-level alarm would most likely be provided in occurrences of this type. Further, required operator action outside of the control room in order to override permissives would most likely not be necessary for these occurrences.

Although the loss of RWST level has a safety significance, the extremely low probability of the above scenario does not give us cause for immediate concern. However, this event is indicative of a class of events that needs to be addressed further. The reference IE Bulletin, 79-24, addressed this subject nearly two years ago; however, our LER search revealed that the incidences of frozen lines have not significantly decreased, despite the Bulletin.

Further, the LER search revealed that the majority of the occurrences could be grouped into three categories; viz: those affecting refueling water storage tank level/borated water storage tank level instrumentation, main steamline pressure and flow instrumentation sensing lines and radiological effluent sampling lines.

In addition, many of the occurrences were directly related to inadequacies associated with the heat tracing provided for these sensing and sampling lines. Some of the commonly reported causes of line freeze-up are: the absence of heat tracing or adequate insulation, de-energized heat trace circuits, improper thermostat settings or sensor location for the heat tracing and space heater failures. With the objective of lowering the rate of these occurrences the following recommendations are provided for your consideration.

1. The Office of Inspection and Enforcement should issue a supplement to IE Bulletin 79-24. The Bulletin should instruct licensees to propose technical specification changes which require daily surveillance during periods of extreme cold weather for lines in the three categories discussed above and any other susceptible lines that have safety significance. Further, these specification changes should include appropriate action statements which supplement this surveillance requirement. As an alternate to daily surveillance, the licensees might rely on design features such as alarmed and/or fully redundant Class 1E heat tracing circuits including electrical

power sources. These designs may accordingly be supplemented appropriately with less stringent technical specification surveillance requirements and action statements.

2. In the near term, the Office of Nuclear Reactor Regulation (NRR) should evaluate, as part of their operating license reviews, the adequacy of the heat tracing or other protective measures associated with these and other lines that could be exposed to the ambient. This review should be supplemented with technical specifications which include appropriate surveillance requirements and action statements. In the longer term NRR should revise the Standard Review Plan to include design requirements, acceptance criteria and review procedures for heat tracing. Further, NRR should revise the Standard Technical Specifications so as to supplement these designs with appropriate surveillance requirements and action statements.

The attached enclosure provides typical examples and highlight information regarding occurrences which are associated with each of the three categories identified above. These examples are intended to provide supporting information for the above recommendations.

Carlyle Michelson

Carlyle Michelson, Director
Office for Analysis and Evaluation
of Operational Data

Enclosure:
As stated

cc w/enclosure:
EJordan, IE
RMattson, NRR
RMartin, NRR
DBissett, ACRS

TYPICAL EXAMPLES AND HIGHLIGHT INFORMATION FOR OCCURRENCES OF INSTRUMENTATION INOPERABILITY DUE TO EXTREME COLD WEATHER

Refueling Water Storage Tank (RWST)/Borated Water Storage Tank (BWST) Level Indication

In December 1980, Arkansas Nuclear One Unit 2, while operating at 77% power, lost all four RWST instrumentation channels when the level transmitters froze. The system heat tracing circuit was de-energized because the main line fuse was removed. This situation would have prevented the automatic change over from the injection to the recirculation mode under LOCA conditions.

Many other occurrences have been reported in which at least one RWST/BWST instrumentation channel was lost due to freezing in the sensing lines or transmitters. These include: five other events at Arkansas Nuclear One Unit 2, five events at Davis Besse 1, seven events at Oconee Units 1, 2, and 3, two events at Sequoyah 1 and one event each at Indian Point 2, Millstone 2, and North Anna 2.

Main Steamline Pressure and Flow Sensing Lines

A reactor trip and safety injection occurred at D.C. Cook 2 in January 1979. This event was caused by the freezing of number two and three steam generator/main steam pressure sensing lines. The ambient temperature around the lines was below freezing due to the failure to close off the steam vent openings in the west steam enclosure.

On two separate occasions the Haddam Neck reactor tripped when main steamline high steam flow signals were received. In each case two sensing lines froze as a result of below freezing weather. One event also involved some openings which were inadvertently left in a wall following high energy pipe break modifications.

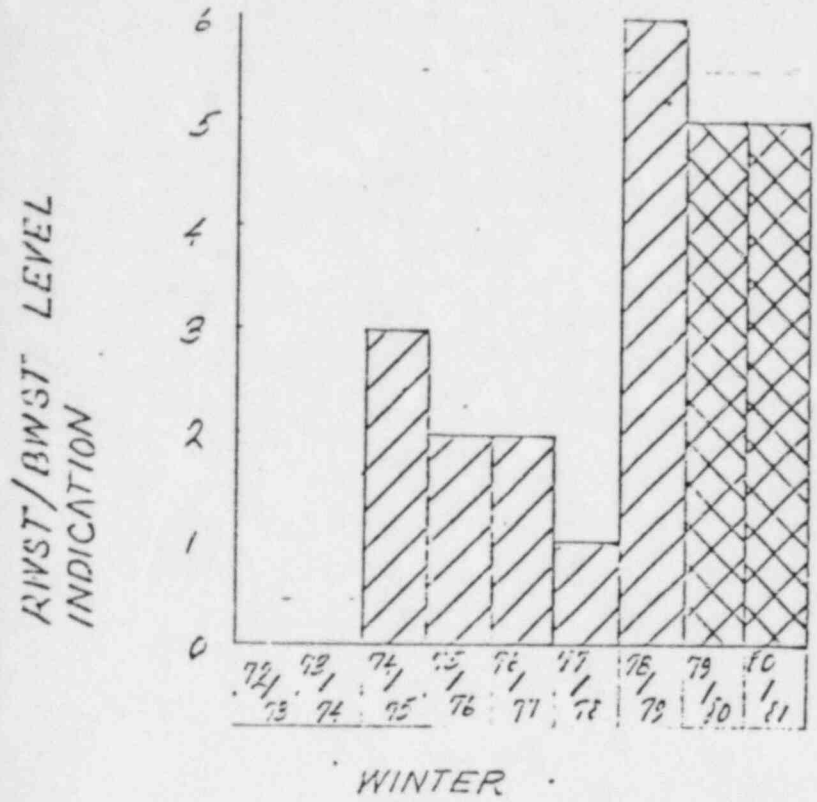
A number of other occurrences have been reported in which at least one steam pressure or flow channel failed due to freezing. These include: one event each at Arkansas Nuclear One Unit 1, Indian Point 1, Farley 1, North Anna 1, Sequoyah 1, Surry 1, Surry 2, Trojan and Zion 1 and two events at Point Beach 1 and Salem 1 and three events at Zion 2.

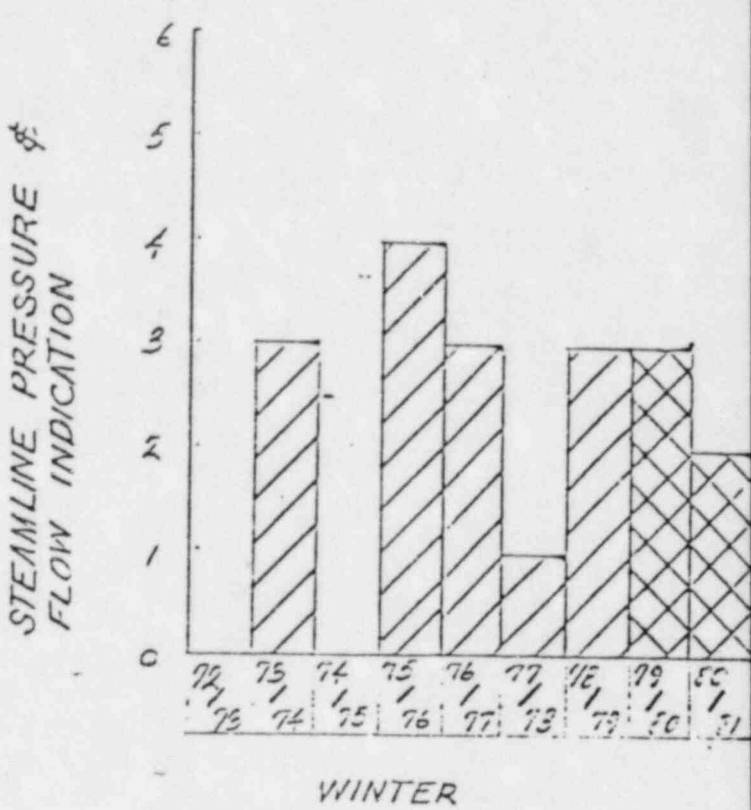
Radiological Effluent Sampling Lines

The stack gas monitoring system at Duane Arnold was declared inoperable on three separate occasions due to freezing in the sample line. The ice formed in sections of the line that were not heat traced. Similar events have also occurred at FitzPatrick, Monticello, Oyster Creek and Pilgrim.

Other Examples of Problems Caused by Extreme Cold Weather

In addition to the above events, several other types of failures have occurred, for example, freezing in the RWST recirculation line, cracking in pipes and valves due to ice formation, loss of feedwater instrumentation channels, and failure of fire protection equipment due to freezing.


RWST/BWST LEVEL INDICATION
0
1
2
3
4
5
6
72/73
73/74
74/75
75/76
76/77
77/78
78/79
79/80
80/81
WINTER


STEAMLINE PRESSURE & FLOW INDICATION
0
1
2
3
4
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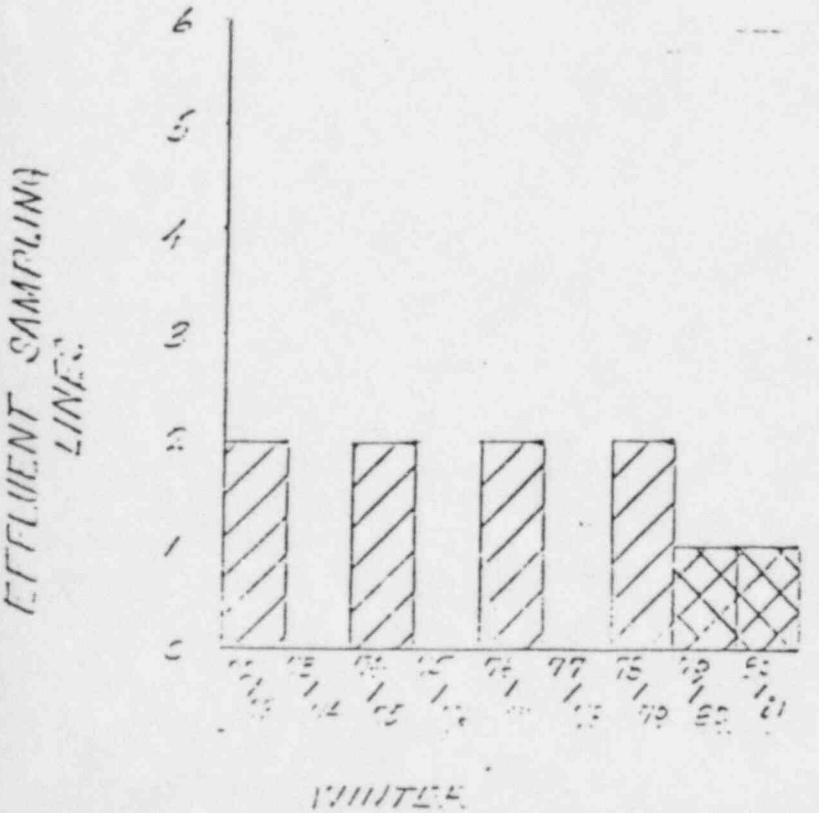
6
72/73
73/74
74/75
75/76
76/77
77/78
78/79
79/80
80/81
WINTER


EFFLUENT SAMPLING LINES
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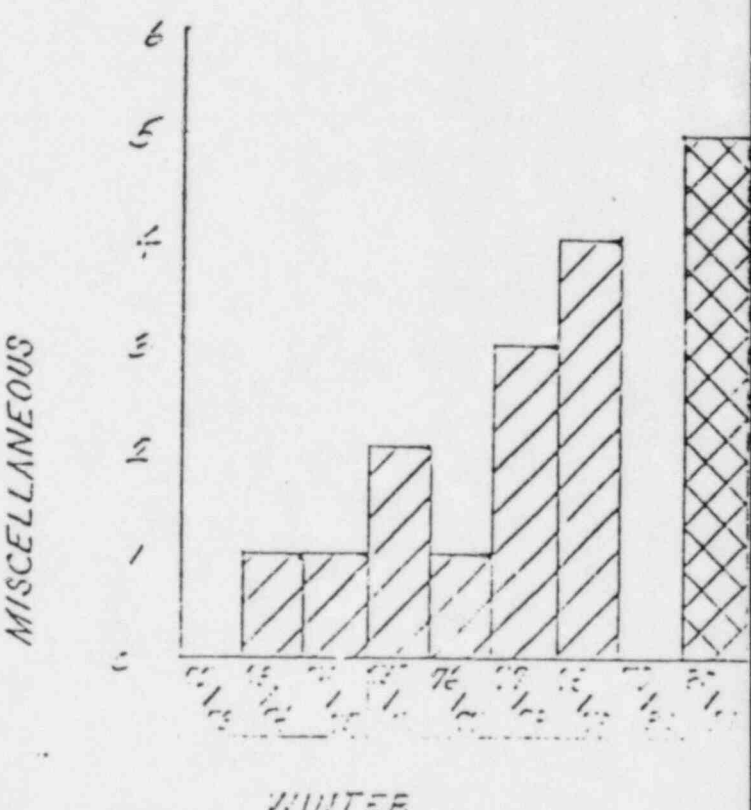
MISCELLANEOUS
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WINTER

JUN 16 1981

MEMORANDUM FOR: Chairman Hendrie
Commissioner Gilinsky
Commissioner Bradford
Commissioner Ahearne

FROM: William J. Dircks
Executive Director for Operations

SUBJECT: MEMORANDUM OF AGREEMENT WITH INPO AND NSAC ON A COOPERATIVE RELATIONSHIP FOR THE COLLECTION AND FEEDBACK OF OPERATIONAL DATA

The Memorandum of Agreement with INPO and NSAC on a cooperative relationship for the collection and feedback of operational data has now been signed by all parties. The copy of the signed agreement is enclosed for your information. The effective date of the Agreement was June 1, 1981.

AEOD will be meeting with INPO and NSAC in the near future to develop the working procedures for the routine implementation of this Agreement.

(Signed) William J. Dircks

William J. Dircks
Executive Director for Operations

Enclosure:
As stated

cc w/enclosure:
Office Directors

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MEMORANDUM OF AGREEMENT

INPO/NSAC-NRC

This memorandum between the Institute of Nuclear Power Operations (INPO), the Nuclear Safety Analysis Center (NSAC), and the U.S. Nuclear Regulatory Commission (NRC) reflects the desire for a continuing and cooperative relationship in the collection, and feedback of operational experience information and data for nuclear power plants. Mutual supportive activities, as defined below, will help assure that the goals and programs of INPO, NSAC, and the NRC will be carried out in the most efficient and effective manner without diminishing or interfering with the responsibilities or authorities of any party.

1. Collection of Operational Data

Since: (a) it is a common objective that reporting of information and data be efficient and duplicative reporting be eliminated; (b) the validity of analysis results may depend upon the completeness of input information; and (c) the effectiveness of operational data feedback is dependent upon a proper understanding of the implications inherent in reactor operating experience INPO, NSAC, and the NRC will endeavor to develop, maintain, and use a common database related to reactor operating experience. In this regard, NRC will consult with and, to the extent appropriate, factor in the recommendations and needs of responsible industry groups including INPO and NSAC in the process of requesting significant revisions to formal data bases such as the Licensee Event Report (LER) system, and the Nuclear Plant Reliability Data System (NPRDS).

Further, INPO, NSAC, and the NRC agree to consult with each other with regard to the availability of technical information which would be useful in ongoing plant event analysis and evaluation activities; and to promote and encourage a free flow of such information if not otherwise restricted from further distribution. This technical information will normally be in the realm of observable data describing plant parameters and occurrence sequences during an event which is under analysis. Both parties recognize the need for excluding from this agreement fragmentary information related to work in progress and information which has been received on a privileged basis. However, as such information is verified and found to be necessary or important to findings upon which significant safety-related conclusions and recommendations are based, the party holding such information will take appropriate and timely steps to remove it from the fragmentary, privileged or otherwise restricted status. It is recognized that the parties to this agreement may not be fully aware of the extent of each other's knowledge and thus, this agreement requires only the parties' best efforts and a reasonable degree of care.

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2. Computerized Data Storage and Retrieval

In order to improve the overall operational data base in terms of completeness, accuracy, and ability to search and recall specific information, INPO, NSAC, and the NRC, will coordinate their efforts towards consolidation and improvement of NRC and industry-supported operational and engineering data bases.

3. Foreign Information

Information and data obtained by the NRC from foreign sources that does not include restrictions on further distribution, will be entered into a computerized databank; and will be readily available for INPO and NSAC analysis activities. Foreign information and data obtained by INPO and NSAC without restrictions will similarly be entered into the same computerized data base for ready access by NRC.

4. Significant Event Screening

INPO and NSAC will provide the NRC with timely listings of the significant events which have been identified by the SEE-IN screening process as significant events for action analysis. Similarly, the NRC will provide INPO and NSAC with the results of its significant event screening procedure which identifies events for engineering evaluation or case study.

5. Coordination Meetings

INPO, NSAC, and the NRC will meet semi-annually to discuss the major generic analyses and event evaluation activities underway and planned. The objectives of such coordination meetings are to provide up-to-date information on each organization's overall plans for the evaluation, analysis, and feedback of operational data, and the allocation of resources. This activity is an effort to avoid unnecessary and unintentional duplication of activities, while providing a means to identify those study areas where independent activities by another organization may be warranted. These coordination meetings are information exchange forums only. Formal requests or agreements on actions or revisions to programs are outside the scope of these meetings.

In addition to meetings, it is expected that frequent, informal communications will exist among the parties with regard to the nature and scope of studies in progress or planned.

6. Exchange of Analysis and Evaluation Results

The results of completed and formally documented generic analyses and event evaluation of operational data, together with the conclusions and recommendations where applicable, will be regularly exchanged between the parties on a timely basis. In addition, informal technical discussion of generic or event specific elements of studies in progress which are of mutual interest may be appropriate as determined on a case-by-case basis by the organization conducting the study.

5/26/81

William J. Dircks
Executive Director for Operations
U.S. Nuclear Regulatory Commission

E. P. Wilkinson, President
Institute of Nuclear Power Operations

E. L. Zebroski, Director
Nuclear Safety Analysis Center

Effective Date: 6/1/81