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AUTH.NAME AUTHOR AFFILIATION
MINECK,D.L. Iowa Electric Light & Power Co.
RECIP.NAME RECIPIENT AFFILIATION
MURLEY,T.E. Office of Nuclear Reactor Regulation, Director (Post 870411

SUBJECT: Forwards response to request for addl info re control room habitability evaluation.Attachment A to ltr describes 900919 event & design mods planned.

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Iowa Electric Light and Power Company

October 28, 1991

NG-91-3284

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Response to Request for Additional Information Regarding DAEC's Control Room Habitability Evaluation
Reference: Letter, C. Shiraki (NRC) to L. Liu (IELP) dated August 2, 1991
File: A-107a

Dear Dr. Murley:

This letter provides our response to your staff's concerns regarding Control Room habitability with respect to the impact of a CARDOX system actuation (Reference). Attachment A to this letter describes the September 19, 1990, event and the design modifications which are planned. It addresses the four issues listed in the enclosure to the referenced NRC letter. Attachment B is a simplified drawing of the ventilation system for the Duane Arnold Energy Center (DAEC) Control Building.

As stated in Attachment A, we are in the process of implementing corrective actions which will ensure Control Room habitability is maintained during a CARDOX actuation. The design modifications will be implemented before shutdown for the Cycle 11 refueling outage (now scheduled to begin February 28, 1992). Post-modification testing during the outage will verify the effectiveness of the modifications before startup. In the next annual update of the UFSAR, the discussion of Control Room habitability will be revised to reflect the evaluation of and corrective actions following the September 19 event.

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Please contact this office if you have any questions regarding this matter.

Very truly yours,

Daniel L. Mineck
Manager, Nuclear Division

Attachment A: Response to Request for Additional Information
Attachment B: Simplified Control Building Ventilation Drawing

cc: P. Bessette
L. Liu
L. Root
R. McGaughy
C. Shiraki (NRC-NRR)
A. Bert Davis (Region III)
NRC Resident Office
Commitment Control 910189, 910191

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

DESCRIPTION OF EVENT

On September 19, 1990, an inadvertent actuation of the Cable Spreading Room automatic fire suppression system (CARDOX) occurred while restoring the system lineup after a surveillance test procedure (STP). Approximately 25% of the CARDOX system volume was discharged into the Cable Spreading Room before the CARDOX tank was manually isolated. The actuation of this system resulted in carbon dioxide (CO2) intrusion into the Control Room primarily via the ventilation path between the toilet area of the Control Room and the Cable Spreading room and to a lesser degree, through Cable Spreading Room/Control Room cable penetrations. Operations personnel quickly identified the initiation of the CARDOX system and took the necessary safety precautions: all non-essential personnel exited the Control Room and the remaining personnel verified the availability of emergency breathing equipment. Measurements of oxygen concentrations in the Control Room by Health Physics personnel showed that oxygen levels did not decrease below 19.4%. Control Room ventilation was increased and oxygen levels were returned to normal (approximately 21%) within minutes. Although neither personnel nor reactor safety were compromised during this event, its potential to affect Control Room habitability was recognized as up to 50% of the CARDOX system volume could have been introduced into the Cable Spreading Room had the operator response not been as prompt. Consequently, an evaluation of the event was initiated.

EVALUATION OF THE EVENT

CO2 leakage into the Control Room was first detected during pre-operational testing in 1974. The problem at that time was thought to be caused by the overpressurization of the Cable Spreading Room during CARDOX initiation. Modifications to the ventilation system were initiated which were designed to provide a pathway to relieve excessive pressure in the Cable Spreading Room thereby eliminating the infiltration of CO2 into the Control Room. In the interim, direction was given to Control Room personnel regarding the potential for CO2 intrusion and subsequent precautions to be taken.

The modifications to the ventilation system were completed in May 1974. Additional fire dampers were installed in the Cable Spreading Room and the CO2-actuated logic on the room exhaust damper (see Damper A Attachment B) was replaced with 360 degree F fusible links. The exhaust damper would then remain open until the fusible links sensed an actual fire (360 degrees F) thereby maximizing the availability of a vent path to prevent overpressurization of the Cable Spreading Room.

In December, 1980, a review of Control Room habitability was performed in accordance with Item III.D.3.4 of NUREG 0737. The focus of our analysis at that time was the evaluation of hazards which could enter the Control Room ventilation system, i.e., external to the Control Building envelope. While our evaluation identified chlorine as the only viable threat to Control Room habitability, other chemicals, including CO2, were evaluated in accordance with the requirements of Regulatory Guide 1.78, "Assumptions for Evaluating the Habitability of Control Room During a Postulated Hazardous Chemical Release". CO2 was not considered a threat because the proposed scenario, a rupture of the CO2 tank in the Turbine Building, did not result in a large enough concentration of CO2 in the Control Room to affect habitability. CO2 intrusion from the Cable Spreading Room was not evaluated based on the assumption that the Control Room would isolate from the Cable Spreading Room upon CARDOX initiation. The details of DAEC's Control Room habitability analysis are contained in UFSAR Section 6.4.

It was during the investigation of the September 19, 1990, event that we identified that the backdraft damper (see Damper B) which was intended to prevent air from backflowing into the Control Room from the Cable Spreading Room was never installed. Design documentation has always reflected a damper in the line and consequently, its presence was assumed in the later habitability evaluations. Despite vigorous efforts, we are unable to explain its absence. Additionally, we determined that upon CARDOX actuation, the room exhaust fan (see Fan X) secures and the fan's discharge damper (see Damper C) closes, effectively blocking the intended vent path. Therefore, the 1974 ventilation modifications were ineffective in that a CARDOX initiation can still pressurize the Cable Spreading Room and, without the backdraft damper, CO2 can backflow into the Control Room.

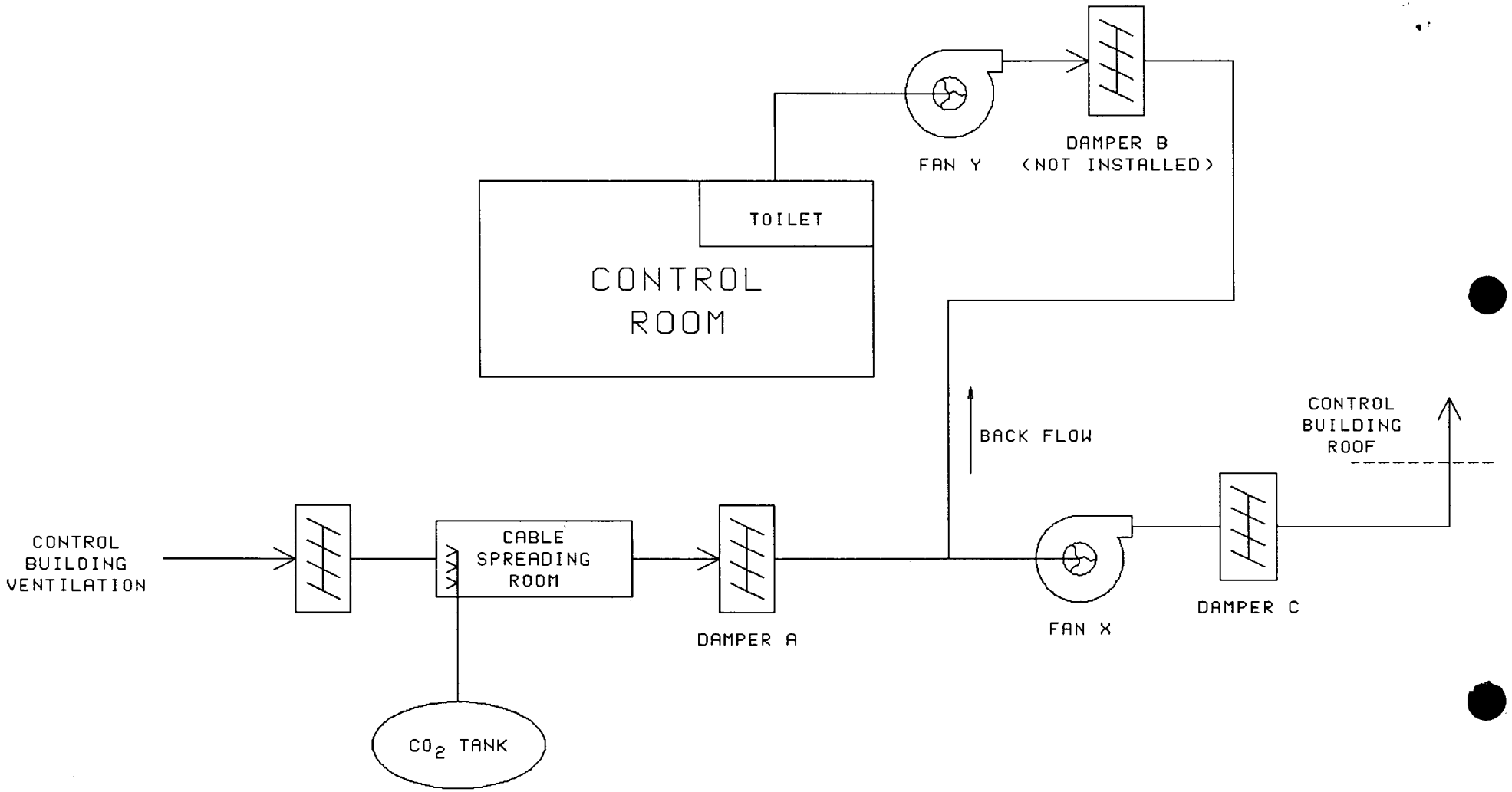
CORRECTIVE ACTIONS

To ensure the safety of Control Room personnel during the evaluation and implementation of corrective actions, the Annunciator Response Procedures (ARPs) for the CARDOX INITIATED and the CARDOX PRE-INITIATION alarms were revised to require the evacuation of all non-essential personnel from the Control Room and all remaining personnel to don emergency breathing equipment. These procedure changes were implemented on October 4, 1990.

The evaluation of a CO2 tank rupture on Control Room habitability as described in UFSAR Section 6.4 assumed a 7.5 ton CO2 release. The CO2 tank installed in the Turbine Building, however, is a 10 ton tank. The CO2 tank-rupture scenario as described in UFSAR Section 6.4 has been re-analyzed assuming a 10 ton release. The results of this analysis indicate that the maximum CO2 concentration in the Control Room increases from 2210 mg/m^3 to 2960 mg/m^3. The revised results are still below the threshold limit of 9000 mg/m^3. The rupture energy of the larger tank was also reviewed. The original analysis of the rupture energy, however, assumed a 10 ton tank, so no further evaluation was necessary. This revised analysis will be included in the next annual update of the UFSAR.

The capability of the Cable Spreading Room/Control Room penetrations to prevent infiltration of CO2 into the Control Room was also reviewed. These penetrations were re-sealed in 1986 with approved fire barrier material in order to comply with 10 CFR 50, Appendix R requirements. While the fire barrier material was never intended to act as an air-tight boundary, the process of sealing the penetrations results in some natural infiltration-prevention properties. This characteristic of the fire barrier materials has never been quantified. The planned modifications to the ventilation system, however, will minimize any pressure differential between the two rooms and, consequently, CO2 intrusion through the penetrations is not expected to adversely affect Control Room habitability. No modifications will be made to the penetrations.

Design modifications have been initiated which will address the backflow through the control room exhaust fan (see Fan Y) and ensure the proper venting of the Cable Spreading Room in the event of a CARDOX initiation. These design changes will be complete prior to shutdown for the Cycle 11 refueling outage. Additionally, post-modification testing will be performed during the Cycle 11 outage to verify the effectiveness of these modifications. Upon successful completion of this testing, the Control Room habitability evaluation described in UFSAR Section 6.4 will be revised to reflect the analysis of and corrective actions resulting from the September 19, 1990 event.



CONTROL BUILDING VENTILATION

(Simplified)