THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

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Dalwyn R. Davidson
VICE PRESIDENT
SYSTEM ENGINEERING AND CONSTRUCTION

May 19, 1982

Mr. Robert L. Tedesco
Assistant Director for Licensing
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
Appeal of Chemical Engineering
Branch Position: Fire Protection

Dear Mr. Tedesco:

In the attachments to a letter of March 12, 1982, from D. R. Davidson to R. L. Tedesco, CEI responded to the Chemical Engineering Branch's concern about use of carbon dioxide as a fire suppression agent in the PNPP control rooms(see CEI response to Question Topic 7). The Chemical Engineering Branch rejected CEI's written response justifying selection of carbon dioxide for the control rooms in an April 26, 1982, meeting between NRC and CEI. This position was reiterated in the DSER. With this letter and its attached discussion further justifying selection of carbon dioxide, CEI is requesting your review of the Chemical Engineering Branch's position on this issue.

The fire suppression system for the PGCC control room originally was designed by CEI to be a Halon 1301 system. This design was described in the original PSAR submitted to the NRC. In response to concerns raised by the NRC reviewer for the PSAR, CEI changed to a carbon dioxide fire suppression system design; the revised system description was incorporated into the PSAR in 1974 with Amendment 17. Now the NRC Chemical Engineering Branch in its review of the PNPP FSAR has stated they require a Halon 1301 system and prefer that Perry switch back to a Halon 1301 system.

At this point, the carbon dioxide fire suppression system is installed in the PNPP control rooms. It will cost CEI about $2,000,000 to design and install a substitute Halon 1301 fire suppression system in the PNPP control rooms.

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In conclusion, a switch back to a Halon 1301 system is not justified; the attached discussion supports the acceptability of carbon dioxide as a fire suppression agent and demonstrates that PNPP has taken adequate precautionary technical and administrative measures to ensure that the safety of control room workers is not jeopardized by a carbon dioxide discharge. We request your prompt review of this issue. A speedy resolution of the carbon dioxide issue will assure that it can be removed from the NRC list of open items for PNPP.

Very truly yours,

Dalwyn R. Davidson

Dalwyn R. Davidson
System Engineering and Construction

DRD: mlb

cc: W. Johnston, NRC
J. Stefano, NRC
M. Gildner, NRC
J. Silberg

Question Topic 7:

PNPP selection of carbon dioxide as the fire suppression agent in the control room.

Response

The Cleveland Electric Illuminating Company changed its primary suppression agent in the control room subfloor area from Halon 1301 to carbon dioxide in response to the NRC's 1974 SER on the construction permit for Perry 1 which stated NRC concerns on the use of halogenated compounds in the control room. The 1974 SER on Perry 1, CP stage, reads as follows:

> "We stated our concerns in Section 9.4.1 of the SER, regarding the use of halogenated compounds in, or in the vicinity of, the control room, due to the reported detrimental effects on operating personnel of these halogenated compounds as well as their pyrolyzed end products. We also expressed our concerns regarding the potential artificial aging or disabling of the safety-related charcoal beds in the control room...
>
> In response to our concerns, the applicants propose in Amendment 17 i.. the PSAR, to remove their Halon 1301 firefighting system from the control room complex and replace it with a carbon dioxide(CO_2) fire extinguishing system which will be permanently installed in the cable spreading area under the raised control room floor...
>
> We find that the proposed use of CO_2 in the firefighting system of the control room complex will not adversely decrease the habitability of the control room since CO_2 is stable and will not produce any toxic decomposition products when used as a fire extinguishing agent. We conclude, therefore, based on our review, that the proposed design criteria for the fire fighting systems in the control room complex are acceptable." (p. 9-17) SER/CP Stage; 1974

However, the draft SER on the PNPP/FSAR Operating License stage(April 1982) indicates that the NRC has reversed its previous acceptance of carbon dioxide as a fire suppression agent in the PGCC control room:

> "The control room complex utilizes the General Electric Power Generation Control Complex (PGCC) design. The applicant has proposed a low pressure, manually actuated, carbon dioxide, extinguishing system to protect this system. Carbon dioxide has not been tested and approved as a suppression agent in a PGCC system. The General Electric Licensing Topical Report NEDO-10466, Revision 2, dated March 1978, which the staff previously approved specifies that Halon 1301 fire protection is required for a

> PGCC system. The staff will require the applicant either to conduct a test program similar to the one performed by General Electric to verify that a carbon dioxide extinguishing system will adequately protect the PGCC system, or comply with the fire-protection specifications in the NEDO-10466 Report, Revision 2.
>
> The staff is also concerned that carbon dioxide may leak from the PGCC under-floor to the control room, resulting in the possible injury of operators and the forced evacuation of the area. The staff will report on this item in a supplement to this Safety Evaluation Report." (p. 9-69) PNPP/DSER-OL Stage

In the following paragraphs, CEI will justify that the PNPP carbon dioxide fire suppression system in the control room: 1) will extinguish deep-seated fire in the subfloor area as well or better than Halon 1301, the agent approved in the GE-NEDO-10466, Rev. 2; 2) a single carbon dioxide discharge in the subfloor area of the control room could not build up to a concentration which could endanger control room workers(i.e., above 9%); and 3) CO_2 monitors/alarms and control room evacuation procedures will insure that even a complete dump of the CO_2 storage tank due to a malfunction of the selector valves will not endanger the control room workers.

The carbon dioxide fire suppression system in the PNPP Unit 1 and Unit 2 control rooms is designed to discharge sufficient carbon dioxide to the subfloor sections during the timer sequence to achieve, at a minimum,: a 30% concentration within 2 minutes, a 50% concentration within 7 minutes, and maintain the 50% concentration for a minimum of 20 minutes. By achieving and maintaining these concentrations, a smoldering fire will be extinguished and the material will be allowed to cool to a point where reignition will not occur. The carbon dioxide concentrations described above meet the requirements of NFPA Standard No. 12 for extinguishing deep seated fires with carbon dioxide (see NFPA Std. 12, (1980), pages 34, Section 2-4). Note that although Halon is often effectively used to extinguish deep seated fires, NFPA Standard 12A,"Halon 1301, Fire Extinguishing Systems" has negative implications about use of Halon 1301 for this purpose(see pages 25, 28, 29, 110, and 111 of NFPA Standard 12A-1980).

Each of the Unit 1 and Unit 2 PNPP control rooms are served by three carbon dioxide systems, each system covering approximately one third of the floor sections. If a fire is detected in one module of the floor section the carbon dioxide system serving the section containing that module would be activated. A single carbon dioxide discharge sequence to a sub-floor section should completely extinguish any fire which could occur there. However, the system has the capability to be reset immediately and activated again numerous times. (Unless the

Halon system has been specifically required to have double shot protection, it will not be able to be utilized again until recharged. Even with a double shot, the system only can be discharged twice in rapid succession.)

PNPP will perform an acceptance test for each of the carbon dioxide systems in the PNPP control rooms to confirm that the system performs as designed and especially to assure that the carbon dioxide concentrations can be maintained. The system design plus the acceptance test will assure that the control room will be adequately protected in the event of a fire.

Personnel Safety: Carbon Dioxide in PGCC Control Room

PNPP has taken a number of precautionary measures to prctect the safety of control room workers when a single discharge of carbon dioxide to a section of the control room sub-floor is triggered. The carbon dioxide system is designed to be manually instead of automatically actuated. When the system is actuated, a local audible alarm activates automatically. The control room also is equipped with monitors which continuously monitor for oxygen deficiency. The sensors for these monitors are located approximately 20 inches off the floor. The monitors are set to alarm when the oxygen content of the room falls below a set level which, although not yet established, will range from 17 to 19.5%. The system is designed to shut off after the amount of carbon dioxide needed for fire suppression in the floor section has been discharged.

The characteristics of carbon dioxide will tend to keep the carbon dioxide from leaking out of the sub-floor and presenting a danger to workers in the control room. Since carbon dioxide is heavier than air, it tends to settle down to the floor even when initially discharged throughout a room; therefore, the carbon dioxide, once discharged, will tend to stay in the floor section.

PNPP has also examined the potential danger to workers of a carbon dioxide discharge while the floor panels are off(a row of floor panels potentially could be removed by maintenance workers testing the CO_2 system). PNPP assumed a worst case to calculate the concentration of CO_2 in the control room: uniform mixing of CO_2 in room; CO_2 does not pass beyond the suspended ceiling; the ventilation system is shut down; no CO_2 leaks from the control room; floor panels are all open and the entire amount of a single CO_2 discharge is dispersed into the control room. With these assumptions, the concentration of carbon dioxide in the control room was calculated to be 3.6%, an amount that NFPA has determined will not be harmful:

"It has been determined by test that atmospheres containing

> 3 or 4% carbon dioxide will cause one to breathe rapidly but will otherwise have no important effect for relatively short exposures..." (NFPA Std. 12-1980, App. A, p. 12-53).

In the unlikely event that a major malfunction in the selector valves causes a dump of the CO_2 storage tank into the subfloor, additional measures will be taken to protect workers. Self-contained breathing apparatus are provided to control room workers. If the control room becomes uninhabitable, means are provided outside the control room to bring the reactor to a cold shutdown condition. Administrative procedures will be written to cover this situation.

Conclusion

The above discussion justifies PNPP's selection of CO_2 as an acceptable fire suppression agent for the control room and demonstrates that PNPP has taken adequate precautionary technical and administrative measures to ensure that the safety of control room workers will not be threatened by carbon dioxide.