G 07/06/78

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SUBJECT:
FORWARDING APPLICANT"S LIC SUBMITTALS IDENTIFIED AS ITEMS 3.2.2, 3.2.3, 3.2.4 AND 3.2.6 (RE SUBJECT FACILITY"S FIRE PROTECTION SYSTEM) OF TABLE 3.1 OF NRC 06/01/78 SAFETY EVALUATION AND ISSUANCE OF LIC AMEND TO APPLICANT, SUBMITTED BY LTR DTD 06/01/78...

PLANT NAME: DUANE ARNOLD

REVIEWER INITIAL: XJM
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REGULATORY DOCKET FILE COPY

IOWA ELECTRIC LIGHT AND POWER COMPANY

General Office

CEDAR RAPIDS, IOWA

LEE LIU
VICE PRESIDENT - ENGINEERING

July 3, 1978
IE-78-1006

Mr. Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Case:

On June 1, 1978 the NRC issued Iowa Electric a license amendment with an attached safety evaluation for the Duane Arnold Energy Center. The amendment, in part, added license conditions in the form of a schedule for licensee submittals related to the Duane Arnold Energy Center fire protection system.

The intent of this letter is to transmit licensee submittals identified as items 3.2.2, 3.2.3, 3.2.4, and 3.2.6 of Table 3.1 of your safety evaluation.

Three signed originals and 37 copies of this letter and attachments are transmitted herewith. This letter and its attachments are true and accurate to the best of my knowledge and belief.

IOWA ELECTRIC LIGHT AND POWER COMPANY

BY: Larry D. Root
Lee Liu for
Senior Vice President, Engineering

LL/RFS/gan

Subscribed and Sworn to before me on this 3rd day of July, 1978

Jean R. Smith
Notary Public in and for the State of Iowa.

Jean R. Smith
NOTARY PUBLIC
STATE OF IOWA
Commission Expires
September 30, 1978

cc: R. Salmon
D. Arnold
R. Lowenstein
R. Clark (NRC)
L. Root
P-72a

781870089

A006 S 3/40 ADD McGovern

3.2.2 Smoke Detection System Tests

In situ tests will be conducted with a suitable smoke generation device to verify that a fire would be promptly detected by installed smoke detectors and that ventilation air flow patterns in the area do not significantly reduce or prevent detection response. Bench tests will be conducted to verify that smoke detectors will provide prompt response and have adequate sensitivity to the products of combustion for the combustibles in the area where smoke detectors are installed. If any fire detection systems are found to be inadequate, appropriate modifications will be made to provide adequate performance.

Response:

After a review of the means available to meet the above requirement, it has been found that there is no suitable smoke generation device which could reasonably be used at the Duane Arnold Energy Center (DAEC). In particular, combustion generated smoke devices are not permitted by BTP 9.5-1, and non-combustion generated smoke would not meet the requirement because the detectors would not be sensing products of combustion for the combustibles in the area. Other tests, such as those described in the Bases of the DAEC Technical Specification (page 3.3-10), only demonstrate that the detectors and circuitry are functional. However, these tests are already performed periodically to meet the requirements of the Technical Specification. It is possible that air flow patterns could be established in the detection areas but it appears that this would clearly fail to meet the requirements of the above paragraph (3.2.2) of the safety evaluation.

It is concluded that there are no in situ tests available which are acceptable; therefore, it is presently intended that none will be performed at the DAEC.

In lieu of bench testing the presently-installed smoke detectors, it is intended that verification will be provided to show that the sensitivity of each detector is suitable for the products of combustion of the combustibles in its area. This verification will be derived from the manufacturer's test data for the detectors. All newly-installed smoke detectors will be bench tested in accordance with the requirements of paragraph 3.2.2 of the safety evaluation.

From conversations we have had with other utilities, it is understood that the NRC is aware of problems related to testing of detector systems. Iowa Electric would be pleased to take part in discussions or meetings with the NRC to satisfactorily resolve these problems.

3.2.3 Cable Fire Barrier Penetrations Test Data

Test data will be provided to demonstrate the adequacy of electrical cable fire barrier penetrations.

Response:

Reporting on the results of electrical cable fire barrier penetration tests is still in process with the architect engineer who is performing the DAEC fire barrier penetration analysis. It is believed that these tests will be acceptable to both FM and ANI. The tests which are being performed are upon various types of barrier penetrations. None are exactly like the DAEC penetrations, however, it is intended that the test results will be utilized to evaluate those at the DAEC. It is intended that the evaluation will be completed by November 30, 1978.

3.2.4 Control Room Fire Hazards

A study will be made to reduce the fire exposure hazard in the control room due to the cable spreading area, computer area and support areas. Proposed modifications will be provided for those areas.

Response:

Final design approval of the security system design is scheduled for July 12, 1978. The results of the study for reduction of fire exposure hazards in the control room, due to the areas described in the paragraph above, will be reported by October 31, 1978.

3.2.6 Diesel Generator Air Intakes

An evaluation of the need for a barrier between the diesel generator air intakes will be provided.

Response:

Physical Layout

The two diesel generators are Fairbanks - Morse Model 38TD8 - 1/8 models, each of 2850 kilowatts capacity from a 4516 horsepower rating at 900 revolutions per minute. Each engine uses from 1.2 gallons of fuel per minute near idle speed to 10 gallons per minute at full load. Fuel oil to the engine is supplied from two 1000 gallon day tanks located in separate rooms which are three-hour fire-rated. The fuel oil is pumped from the day tank to the diesel generator by an engine-driven fuel pump which supplies 11.2 gallons per minute on a continuous basis. Fuel oil not required for combustion in the diesel engine is bypassed through a return line to the day tank by a throttle valve.

Combustion and ventilating air is supplied by axial fans which provide 38,000 cubic feet per minute to each diesel room. During diesel operation, the turbocharged engines utilize room air at rates which vary depending on engine load, but which reach 11,000 cubic feet per minute at full load for each engine. The diesel generators run at full load in almost every instance of operation. The remaining 27,000 cubic feet per minute of ventilating air is discharged through gravity-operated discharge louvres.

Ambient air to supply the diesel generator rooms is drawn in through intake louvres which are side-wall mounted in the turbine building at a base elevation of 816 feet. The two sets of intake louvres are 13 feet high and 11 feet wide, and have a 1.5 foot separation between them. Air is inducted through these louvres through a plenum to ducts which feed air separately to the two diesel rooms below. Axial induction fans are installed in the ducts, and supply 38,000 cubic feet of air per minute to each room. The diesel generators discharge combustion air through mufflers and exhaust pipes in the side of the building. The balance of the room air is exhausted through louvres at a base elevation of 772.5 feet. These louvres are 3 feet high and 13 feet wide. The minimum distance between exhaust and intake louvres is 40.5 feet, with the intake louvres being located directly above the exhaust louvres.

Hypothetical Accident

A number of accident possibilities which could result in diesel oil spillage, subsequent ignition and a fire in one of the diesel generator rooms were evaluated. Most of these scenarios, such as breaking of the diesel oil fuel line, would result in fuel starvation to the engine, an engine stoppage, and the cessation of fuel flow due to concurrent stoppage of the engine-driven fuel pump. One hypothetical accident allowed for the diesel generator to continue operation for a period of time; it is this scenario which was selected for the accident analysis. In this scenario, it is hypothesized that the fuel oil return line from the engine back to the day tank ruptures. The engine continues running, and bypassed diesel fuel is pumped from the ruptured line into the room. It is further hypothesized that one of the five floor drains in the diesel room is blocked, allowing the fuel from ruptured line to pool over a portion of the floor. It is further assumed that an ignition source of sufficient energy is available to ignite the spilled oil, and does so. The result is a conflagration in one diesel generator room.

Accident Analysis

The room in which the diesel oil fire takes place is supplied with 38,000 cubic feet of outside air per minute. This quantity of air is sufficient to sustain a fire for a period of time. The rupture of the fuel oil return line results in a release of 1.2 gallons per minute. It can also be assumed that one of the five floor drains is blocked, resulting in a pooling of the diesel oil in an area approximately 11 by 16 feet to an average depth of 3/4 inch. This results in a pool of about 85 gallons on the floor. Diesel fuel burns at a rate of approximately 4 millimeters a minute in an open pool.[1] It was estimated from the above that a sustained fire would consume a total of 18.7 gallons per minute of fuel oil, and would require approximately 27,000 cubic feet of air per minute. The diesel engine would use 11,000 cubic feet per minute, up to the point where the engine stalls due to fire, heat and feed air effects. Of the 38,000 cubic feet of air per minute, all is theoretically used to sustain the fire and engine requirements for five or more minutes. The discharge of gases from the diesel room exhaust louvres would be essentially depleted of oxygen. Due to the heating of the gases, it has been calculated that the exhaust gas velocity from the louvres would be a minimum of 37 feet per second.

The composition of gases resulting from a fire such as described above are unpredictable. Emissions from the louvres may include dense smoke, flames, hot combustion gases (primarily carbon dioxide), and the hot products of partial combustion. These products depend on the location of the fire in the diesel room, the type and intensity of the fire, and other factors. Nevertheless, in this analysis, it has been calculated that the gases from the exhaust louvres are completely depleted of oxygen.

Due to the complexity of air flows around buildings, current state-of-the-art in mathematical modeling of atmospheric phenomena does not include a numerical or analytical method to describe a horizontal jet of hot gases from the face of a building and its subsequent dispersion. A number of empirical and semi-empirical methodologies from the literature,[2, 3, 4] were examined. Attempts were made to apply these methods to the problem. It was concluded that even empirical methods which are available do not lead to realistic numerical solutions. For example, use of the Halitsky wind-tunnel results[2] yields non-meaningful values of dispersion, primarily due to the fact that the Halitsky values are derived from a 1 to 1, or 2 to 1, ratio of exit velocity to wind speed at little or no temperature difference, whereas the effluent gases from a diesel room fire exit the exhaust louvres at an order of magnitude greater than normal ambient wind speeds, and at temperatures 1200 degrees or more higher than ambient temperatures. Thus, from lack of existing analytical methods, quantitative answers to the questions are not provided.

Qualitative Probable Solution

Although the problem does not yield to a mathematical solution, it is suggested that the high exit velocity and temperature of the exhaust gases from a diesel room fire would result in substantial horizontal travel of the plume away from the wall of the turbine building, and subsequent translation of the horizontal trajectory into a vertical trajectory due to bouyancy from the very large temperature difference. These two factors will result in rapid dynamic and turbulent mixing and entrainment of ambient air into the exhaust plume, providing rapid dilution of the oxygen-deficient plume. This type of violent mixing generally results in dilution by an order of magnitude or more. (3) Such probably being the case in this instance, the diluted plume would not interfere with operation of the other diesel generator in the event that exhaust gases were recirculated through the intake louvres and air plenum. In regard to the last point, it is considered unlikely that any significant quantity of the exhaust gases would reach the intake louvres due to high initial horizontal gas velocities away from the building, and because of the high vertical velocities of the gases due to very high temperatures relative to ambient temperature.

Therefore, it is concluded that there is no need to provide a barrier between the diesel generator air intakes.

References

(1) Atallah, S. and D. S. Allan, "Safe Separation Distances from Liquid Fuel Fires," Combustion Institute Meeting on Disaster Hazards, Houston, Texas, 1970.

(2) Halitsky, J., Gas Diffusion Near Building, New York University, Geophysical Sciences Laboratory Report 63-3, February, 1963.

(3) Halitsky, J., "A Method for Estimating Concentrations in Transverse Jet Plumes," International Journal of Air and Water Pollution, Volume 10, pp. 821-843, London, 1966.

(4) Slade, D. (Ed), Meteorology and Atomic Energy, pp. 221-225, U.S. Atomic Energy Commission, Washington, D.C., 1968.

Docket
50-331

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

June 21, 1978

All Power Reactor Licensees

Gentlemen:

SUBJECT: REVISIONS TO INTRUSION DETECTION SYSTEMS AND ENTRY CONTROL HANDBOOKS AND NUCLEAR SAFEGUARDS TECHNOLOGY HANDBOOK

Enclosed is a copy of the Nuclear Safeguards Technology Handbook which was prepared under contract for the Department of Energy (DOE). The purpose of this handbook is to convey an understanding of the current SS safeguards technology development program and its prospective relevance and use to U.S. industrial and utility organizations, as well as to other U.S. government agencies and international organizations.

Also enclosed are updates to the "Entry-Control Systems Handbook" and the "Intrusion Detection Systems Handbook" that were sent to you earlier.

Sincerely,

James R. Miller

James R. Miller, Assistant Director
for Reactor Safeguards
Division of Operating Reactors

Enclosures:
As stated

cc w/o enclosures:
Service List

Tllsc4

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