DEC 27 1977

POOR ORIGINAL

Docket No. 50-346

APPLICANT: Toledo Edison Company

FACILITY: Davis-Besse, Unit 1

SUBJECT: SUMMARY OF MEETING HELD ON DECEMBER 6, 1977 WITH THE TOLEDO EDISON COMPANY REGARDING FIRE PROTECTION IN THE FACILITY CABLE SPREADING ROOM - DAVIS BESSE, IT 1

A meeting was held on December 6, 1977, with the Toledo Edison Company and the NRC staff regarding the fire protection capabilities for the cable spreading room for Davis Besse, Unit 1 (DB-1). An attendance list is provided in Enclosure 1.

SUMMARY

The Toledo Edison Company (TECO) presented the fire protection design characteristics of the DB-1 cable spreading room which utilizes a defense-in-depth philosphy. TECO stated that the cable spreading room design and attendant administrative control provide assurance that, (1) the causes of electrically originated fires within the cable spreading room are virtually eliminated, (2) confine damage caused by electrically originated fires within the cable spreading room to a single channel Class IE or non Class IE raceway and (3) preclude the causes of non-electrically originated fires in the room itself. Enclosure 2 provides a detail summary of the cable spreading room design and administrative control procedures as presented be TECO.

TECO stated that the measures taken with regard to the design of the cable spreading room precludes the existence of an electrical originated fire in the cable spreading room. Also, if such fires are postulated to exist, these fires will be contained within the raceway which encloses the faulted circuit.

TECO stated that administrative procedures virtually eliminated the threat of an exposure fire in the cable spreading room. The administrative procedures include: (1) the control of access by way of locked doors with alarms to the control room and gate house and the accompanying of the fire marshall of his designated alternative, (2) the strict control of ignition devices and combustibles, and (3) the prohibition of combustible storage.

The NRC staff stated that they were most anxious to obtain copies of the slides presented at the meeting which showed the fire tests which have been conducted by TECO. TECO later stated that the slides as well as the details of the fire tests would be provided as an appendix to their forthcoming amended Fire Hazard Analysis Report for DB-1.

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Also, the NRC staff stated to TECO that they were presently evaluating the possibility of an exposure fire in the cable spreading room and would advise TECO on the staff's conclusions after further staff evaluation of the forthcoming amended Fire Hazard Analysis Report for DB-1.

Original signed by
Leon B. Engle

Leon B. Engle, Project Manager
Light Water Reactor Branch No. 1
Division of Project Management

Enclosure:
1. Attendance list
2. Fire Protection Design Evaluation

cc: See next page

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ENCLOSURE 1

MEETING ON DECEMBER 6, 1977
THE TOLODO EDISON COMPANY
DAVIS BESSE, UNIT 1
50-346

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L. Engle
G. Harrison
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P. Matthews
D. Notley
A. Szukewicz

TEC

Calcamuggio
W. Mitchell

M&M Protection Consultants

J. Robinson
R. Weiss

Bechtel Corporation

P. Anas
S. Carter
R. Jackson
R. Madden
R. Manney
C. Miller
E. Ray
G. Stashik

ENCLOSURE 2

FIRE PROTECTION DESIGN OF THE CABLE SPREADING ROOM FOR DAVIS BESSE, UNIT 1

ENVELOPE OF ROOM

The free volume of the Cable Spreading Room is approximately 60,000 cubic feet. The envelope of the room is composed of walls, floors, ceilings, penetration seals, and access doors all of which carry fire ratings. Floors, walls, and ceilings are all fire resistant concrete or 12 inch masonry concrete block carrying 3 hour ratings. Both main access doors are also 3 hour rated. In addition, the 2'8" x 2'8" elevator access door is also rated 3 hours. The 2-1/2' x 2-1/2' floor access hatch is a 3 hour rated door although it does not carry a full rating when oriented in the horizontal position.

In order to maintain the fire rating integrity when openings for mechanical or electrical functions (ducts, cable trays, conduit, etc.) must breach a wall, ceiling, or floor, penetrating seals were employed. These seals are composed of silicone foam material which was provided and installed by BISCo. Inc., of Elk Grove, Illinois. The foam material which is also used extensively throughout the remainder of the plant as well, has been tested to attain a 3 hour fire rating in accordance with ASTM E-119. The sealant material properties and testing were described in a report submitted to the Nuclear Regulatory Commission on August 18, 1977.

Access to the cable spreading room is through a door on a landing of a stairway, called AB-1, through a hatch at the top of a sectional ladder above the stairwell door near Elevator No. 3 and through a door from a platform reached by a ladder in a room designated as Room 422B. However, since there is virtually no equipment in the room there is no reason for immediate access to the room itself and therefore, entry will be strictly controlled by TECO. The doors will always be locked with the appropriate key available only from the shift foreman with the concurrence of the station fire marshall or his designated alternate. Each entrance to the room is monitored by the Contact Logger. Opening of the door or hatch initiates a change of state status alarm in the Main Control Room via the Contact Logger which provides specific identification information. The person seeking access will be accompanied by and remain with the fire marshall or his designated alternate. This procedure will be utilized for maintenance, housekeeping or for any other access reasons, if any, to the Cable Spreading Room.

Administrative procedures will control the introduction and use of combustible material and ignition sources into the Cable Spreading Room. A combustible material permit approved by the shift foreman and the station fire marshall or his designated alternate will be issued for all entry to the Cable Spreading Room exclusive of responses to fire alarms. In addition, when applicable, an open flame, welding, and cutting permit will be issued by the shift foreman and maintenance engineer or maintenance foreman.

These permits will contain information such as who initiated the entry request, who will enter, reasons for entry, combustible material and ignition source checklists which will be reverified upon exiting, and special precautions and limitations which will identify, for example, placement of fire extinguishers. Control of this type plus the fact that no storage of combustibles or ignition sources will be permitted in the Cable Spreading Room eliminates any concern for an exposure fire.

The only ducts entering or leaving the cable spreading room are the supply and return air ducts from the control room air conditioning system. These air supply and return ducts are provided with 3 hour rated fire dampers which conform to National Fire Protection Association Code 90A and carry an Underwriters Laboratory Lable. The dampers close automatically and remain tightly closed upon the operation of a fusible link at approximately 160 F. Therefore, fire external to the cable spreading room is prevented from being transmitted to the room via the ductwork.

In addition, sensing devices (temperature switches, firestarts and duct smoke detectors) are provided in the main air supply and return ducts to detect, alarm and shutdown the fans in case of fire. This back up protection aids in preventing the ingress of fire and smoke into the cable spreading room. In addition to automatic actuation, manual shutdown of the fans and closure of the electrically operated isolation dampers is possible from the Main Control Room.

CONTENTS OF ROOM

Since the function of the cable spreading room is to serve as a marshalling area for all circuits external to the cable spreading room that interface with the main control room and cabinet room immediately above, the significant contents of the room are cables and associated raceways (tray, wireway and conduits) as required. With one exception, the cable spreading room does not contain equipment such as switchgear, power transformers, control cabinets, rotating equipment, power cable greater than 125 volts, or potential sources of missiles or pipe whip. The only exception is a 30 DBA, 480-120/208, dry type lighting transformer with its power feed in conduit, and a associated lighting panel board. The only instrumentation in the room are five ionization type smoke detectors and communication equipment which includes two hand sets and two speakers.

The need for access to the Cable Spreading Room during plant operation is minimal. There is very little equipment in the Cable Spreading Room requiring maintenance, and there is virtually no equipment requiring operation. Access of personnel and material into the room is strictly controlled via administrative procedure. The chances of fire in the Cable Spreading Room are, therefore, much less than chances of fire in a similar sized room which is heavily trafficked in an uncontrolled manner.

ROOM ARRANGEMENT CRITERIA AND TOLEDO EDISON TESTING

The race ways in the Cable Spreading Room consist of trays, wireways, and conduits which are arranged according to plant separation criteria, as well as the requirements of the main control room and cabinet room equipment locations. Significant points are two fold. First, the tray system utilized at DB-1 makes exclusive use of ladder type trays with solid bottoms. Second, the choice of this type of tray rather than open bottom trays was confirmed quite markedly in a test conducted at Anaconda on April 25, 1973. This test, as well as others including raceway and cables commenced prior to the issuance of IEEE 383-1974. These tests reflect the effort to have the electrical system design to eliminate or at least minimize the occurance of an electrically originated fire at DB-1. The results of the test at Anaconda are as follows:

1. Flame propagation and cable ignition are retarded due to the thermal barrier provided by the 1-1/4 inches of air space between the tray bottom and top of cable support rungs. This space also tends to trap flame retarding gases around the cable to inhibit after burn.

2. The major part of falling and thrown ash was retained in tray due to the solid bottom configuration. This reduces propagation of fires to lower trays.

3. Time-to-failure of cables was improved over the manufacturer's guaranteed 5 minutes because of the thermal barrier provided by the tray system design.

Earlier tests, July 28, 1971 and January 26, 1972 (conducted at the Okonite Company) were performed on various tray configurations utilizing various tray covers (solid, vented and without covers). These tests showed a marked tendency of trays with consecutive sections of covers, both vented and solid, to cause a chimney effect and hence fire propagation. It is for this reason that the indiscriminate use of tray covers has not been allowed. Where absolutely necessary for physical spearation or flame barriers as required by R.G. 1.75, tray covers are used but only in very short sections.

The majority of cables specified for use at DB-1 meet or exceed the requirements of IEEE-383-1974 even though the purchasing documents prepared by TECO and Bechtel preceded by two years the issuance of the IEEE document.

Except for very limited quantities of cable with thermoplastic insulation. all cables are insulated with a type of thermosetting insulation (ethylene-propylene rubber or cross-linked polyethylene). The benefit of the thermosetting insulation is that there is very little tendency to soften when subjected to heat.

Thermotplastic cables are provided as part of two different vendor packages. One vendor package has provided some teflon insulated and jacketed interconnecting cable which has been assigned to its own dedicated wireways. It is also encased in silicone foam within these same wireways in order to reduce the heat transfer to or from another raceway.

The second vendor package has provided PVC insulated cable enclosed within a thermosetting Neoprene Jacket. This cable is qualified to IEEE 383-1974, and is, therefore, installed with other non-Class IE cables.

Additional testing by TECO was conducted between September 1975 and November 1976. These tests, again, emphasize the concern for creating a non-fire propagating cable and raceway system for use at DB-1. The September 1975 test, at Essex, was done to investigate the flame propagation characteristics of cable pulling compounds. The following conclusions were established based on the test:

1. Cable pulling compounds tested have no adverse effects on the flame propagation characteristics of the cables being used at DB-1 as no flame propagation occurred during these tests.

2. Cables installed in conduit have their non-flame propagating characteristics greatly improved by being installed in conduits.

3. A cable fire at the entrance to a conduit will not propagate through the conduit.

The tests conducted at the Essex Company during October of 1975 verified the tray separation criteria used at DB-1. The following conclusions were established based on the test results.

1. Cable and tray installations as used at DB-1 do not propagate fire from one essential channel to another.

2. These tests justify the cable tray stacking as designed for DB-1 by failure to propagate a fire to a tray above, or to trays above and adjacent.

The tests conducted in February 1975 on-site at DB-1 were done to determine the effect of electrical overloading cables in trays and conduits. The observations were as follows:

1. Control and instrumentation cables in conduit will not self-ignite.

2. An overloaded cable will not provide a source of fire to surrounding external cable.

3. Cables surrounding an overloaded cable will show some damage to the cable jacket, but will not self-ignite.

Tests conducted in May 1976 at the Essex Company were used to determine the effects of temperature on cables in conduit when close to an external heat source.

Tests revealed the following:

1. Instrument, control and power cables in conduit have shown no

failures of loss of circuit integrity in time frames up to 45 minutes with top of conduit temperature of 700°F.

2. As the conduit temperature is increased toward 900°F, time to failure is decreased to about 13 minutes.

3. Swelling of cables was due to excessive heat.

The most recent test conducted by TECO was done in November 1976 at the Essex Company. The purpose of this test was to validate the benefit of blanketing cable trays with Kaowool, manufactured by the Babcock & Wilcox Company of 8 lb. density and 1" thickness to prevent heat transfer from a cable fire to raceways (i.e., cable trays, conduit and wireways) located above. The test revealed the following:

1. There were lower than expected temperatures on the surface of the Kaowool. This was due to the smothering effect of the Kaowool in trapping flame retardant gases from cable and thereby not allowing cable fire to propagate or become well established.

2. Heat transfer through Kaowool will not damage cables in raceways above.

3. Koawool greatly reduces release of smoke to surrounding atmosphere. This unexpected benefit aids in manual fire fighting of cable fires by greatly improving visiblity and reducing breathing difficulties.

During the design phase of DB-1 complete adherence to the Regulatory Guide 1.75 "Physical Independence of Electric Systems" was not possible since plant design pre-dated the issuance of R.G. 1.75 as well as IEEE 384-1974. However, the independence principles followed in the DB-1 design are considered adequate to preclude a common failure mode for the postulated design basis event and do, in fact, represent independence principles equivalent to R.G. 1.75.

A complete discussion of the degree of conformance, as far as the entire unit is concerned, is presented in the FSAR for DB-1, both as a response to Question 8.1.2 as well as in various sections of Chapater 8. Insofar as the cable spreading room, the separation distances between redundant channels of Class IE open tray become somewhat marginal when compared to the 3 feet vertical and 1 foot horizontal clear space distance of the guide. The same situation exists between Class IE and non-Class IE. It was decided, therefore, to cover all trays in the cable spreading room rather than run the risk of missing one or two that should be covered. The covering is acheived by the use of thermal blankets made of Koawool material.

The initial decision to use thermal blankets was based on almost identical applications of the blankets in the steel industry. This decision has been reinforced by the previously discussed test findings of TECO.

ELECTRICAL FIRES PRECLUDED FROM STARTING

TECO is confident that the cabling system has been engineered to minimize or virtually eliminate the causes of electrically originated fires.

Cable selection for particular circuit functions has been done conservatively taking into account such factors as conductor grouping, conduit grouping, seal and barrier materials, elevated ambient [illegible] ampacity ratings, etc. This precludes overheating as an ultimate heat source producing insulation failure and consequential fault. Improbable faults, themselves, including arcing faults which represent the greatest threat and the most likely cause of fire because of the arc energy concentration, will be interrupted by the upstream circuit protecting device. Additionally, the care taken during construction such as meggar testing after pull, deburring rough surfaces of raceway, use of smoother type fittings, etc., help guarantee the integrity of the insulation and jacketing system after installation.

SPECIAL TESTS

Additional testing and test results included:

First, a series of tests sponsored by TECO and conducted at the Franklin Institute Research Laboratories was conducted to investigate the safety-related aspects of conduit spacing. These tests related mainly to aspects of R.G. 1.75. However, a significant finding was that ignition of heavily overloaded cable did not occur within the volume of the conduit through which it was run. This finding reinforces the results of the September 1975 testing mentioned previously.

Since all power cable within the Cable Spreading Room is enclosed in conduits, no Cable Spreading Room fire can result from power cable massive overloads. Power circuits are those which continuously carry more than 10 amps per conducter or are greater than 150 volts regardless of current.

The Franklin Institute test program was conducted from December 1976 through March 1977. The summary test report, submitted to the NRC by TECO in March 30, 1977, does not discuss this finding since the testing was to provide the technical basis for electrical conduit separation rather than flame propagation.

The second special program, a water permeability test, was conducted on the type of Koawool used at DB-1. The test, conducted in December 1976 at the Refractories Division of Babcock and Wilcox, assures that water can be sprayed over Koawool during a fire and thereby extinguish the flame with no difficulty. Thus, fire fighting is possible through the Koawool even though the Kaowool barrier will not allow cable fire to propagate or become well established as proven by the Novmeber 1976 testing at the Essex Company.

FIRE DETECTION AND SUPPRESSION

The fire and smoke detection and associated alarming are achieved as follows. Five (5) area ionization type fire and smoke detectors are provided in the Cable Spreading Room. These detectors alarm visually and audibly on a fire alarm panel located in the Main Control Room.

The fire alarm panel sends intelligence to the Contact Logger which prints out a description of the panel on which the alarm exists. Concurrent with the printout, the Contact Logger initiates a trouble alarm via the Control Room Annunciator. The annuciator alerts the operator of the message on the Contact Logger printer.

There are three separate Contact Logger printers. One is located in the control room, another is located in the gate house, and the third is located in the computer room and auto-starts if either of the other two are off or fail. In addition the contact Logger printer in the gate house is continuously monitored by a guard 24 hours a day.

The primary method of fire suppression in the Cable Spreading Room is utilization of two hose lines, one from Hose Rack No. 16 and the other from Hose Cabinet No. 27., both accessible to the Cable Spreading Room. Hose Rack No. 16 located in Stairway AB-1. is directly accessible to the Cable Spreading Room by bringing the hose line through the Cable Spreading Room access door 423A.

Hose Cabinet No. 27 located on Elevation 603'0" in corridor 411 is accessible to the Cable Spreading Room by introducing the hose line up, into, and through Cable Spreading Room access door 423B.

The backup method of suppression is the utilization of the hose line from Hose Rack No. 20 located on Elevation 603'0" in Stairway AB-1. This backs up Hose Rack No. 16. In the event additional hose lines are required, a hose line can be connected to the standpipe fire department connection on Elevation [illegible] in Stairway AB-2. This hose line, once connected to the stand[illegible], can be brought up the sectional ladder which is to adjacent to the standpipe in the stairway and then through the cable spreading room floor hatch into the standpipe in the stairway and then through the cable spreading room floor hatch into the Cable Spreading Room. In addition, protable carbon dioxide fire extinguishers are located adjacent to and outside the entrances to the Cable Spreading Room. In additon, protable carbon dioxide fire extinguishers are located adjacent to and outside the entrance to the Cable Spreading Room.

In the event that fire condition exists in the Cable Spreading Room, the ionization fire and smoke detectors will sense this condition and alarm on a fire alarm panel located in the Main Control Room.

Upon annuciation of the alarm in the control room, the following sequence of events tak place based on the DB-1, Fire Emergency Procedure.

1. An operator who is also a fire brigade member is dispatched to the cable spreading room. If a fire exists, regardless of the size, he notifies the control room using the units public address system of the exact location, the intensity of the fire, type of material burning and then procedes to shut off the ventilation in the area of the fire.

2. Upon notification to the control room that a fire exists, the fire alarm signal is sounded over the unit's public address system and the shift foreman on duty is notified of the fire. The shift foreman determines whether the local fire department is to be alerted and/or summoned.

3. Once the fire alarm is sounded, the location, intensity of the fire and type of material burning is announced over the unit's public address system.

4. The fire brigade responds to the fire with appropriate fire fighting and protective equipment such as Scott Air Packs, fire coats, boots and helmets. Smoke removal will be accomplished by use of portable fans which will exhaust into flexible hoses approximately two feet in diameter. If the fire does not block access to door 423A, the hoses will normally be routed through this door and descend to ground level in stairwell AB-1. The hoses will then exist the building from an emergency door of the turbine building, and the exhaust will be blown into the atmosphere. If the fire location precludes access to door 423A, the hoses will then be routed through one of the other room exits.

5. The fire brigade uses either the hand portable fire extinguishers or hose streams deployed from adjacent hose station lines to extinguish the fire as previously discussed.

MEETING SUMMARY

Docket File
NRC PDR
Local PDR
TIC
NRR Reading
LWR #1 File
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