NRC-01-053

NMC
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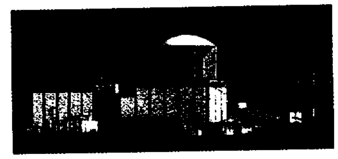
Kewaunee Nuclear Power Plant
N490, State Highway 42
Kewaunee, WI 54216-9511
920-388-2560

Operated by
Nuclear Management Company, LLC



April 30, 2001

10CFR 50.73

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Ladies/Gentlemen:

DOCKET 50-305
OPERATING LICENSE DPR-43
KEWAUNEE NUCLEAR POWER PLANT
REPORTABLE OCCURRENCE 2001-002-02

In accordance with the requirements of 10 CFR 50.73, "Licensee Event Report System," the attached Licensee Event Report (LER) for reportable occurrence 2001-002-02 is being submitted. This report replaces LER 2001-02-01 in its entirety. This report contains the following commitments: redesign the unqualified barrier to comply with Appendix R, complete a root cause evaluation of the event, and submit a supplemental LER.

Sincerely,

Kyle A. Hoops
Manager-Kewaunee Plant

GIH

Attach.

cc - INPO Records Center
US NRC Senior Resident Inspector
US NRC, Region III

NRC FORM 366 (1-2001)	U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB NO. 3150-0104 EXPIRES 6-30-2001

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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TITLE (4)

Non-Rated Fire Barrier Separating Redundant Appendix R Safe Shutdown Capabilities

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER 05000
02	14	2001	2001 B	002 B	02	04	30	2001	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N
POWER LEVEL (10)	096

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR ∋: (Check all that apply) (11)

	20.2201(b)		20.2203(a)(3)(ii)	X	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)
	20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)	50.73(a)(2)(x)
	20.2203(a)(1)		50.36(c)(1)(i)(A)		50.73(a)(2)(iv)(A)	73.71(a)(4)
	20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)	73.71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)	OTHER Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)	
	20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)	
	20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)	
	20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)	
	20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Larry L. Limberg – Fire Protection Process Owner	(920) 388-8208

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X	YES (If yes, complete EXPECTED SUBMISSION DATE).		NO		7	30	2001

On February 14, 2001, with the reactor at 96 percent power, Kewaunee Engineering staff determined there was insufficient test documentation available to support the fire rating of a 10CFR50, Appendix R, fire barrier. The barrier, identified as PB 2105, was constructed to separate Train "A" (dedicated) safe shutdown equipment cables that are routed in a Train "B" (alternate) safe shutdown equipment room. This event is being reported because barriers constructed to demonstrate conformance with 10CFR50, Appendix R, are required to have a three-hour fire rating. The barrier was installed in the 1984 to 1985 time frame. Subsequent inspections of the barrier also recognized the configuration not being in accordance with Appendix R.

Preliminary findings from the root cause evaluation of the event to date reveal the initial design assumptions for similarly constructed penetrations and boundaries were inappropriately used as the basis for accepting PB 2105. The cause evaluation also appears to indicate that we misapplied Generic Letter 86-10 guidance to determine that the design configuration would meet the hazards present in the area.

The root cause determination continues and final results will be reported as a supplement to this LER. Additionally, Underwriters Laboratory testing has been completed on a facsimile of the pull-box. Results of that testing demonstrated the fire rating of the pullbox is adequate for the hazards in the area. The results of the testing will also be reported in the supplement.

Compensatory measures required by the Kewaunee fire plan for an inoperable fire barrier are in place and will remain in place until the pull box is redesigned to comply with Appendix R requirements.

DESCRIPTION OF EVENT

On February 14, 2001, with the reactor at 96 percent power, the Kewaunee Engineering staff determined that there was insufficient test documentation available to support the fire rating of a 10CFR50, Appendix R, fire barrier. The barrier, identified as PB 2105, was constructed to separate Train "A" (dedicated) safe shutdown equipment cables [CBL] that are routed in a Train "B" (alternate) safe shutdown equipment room. This event is being reported because barriers constructed to demonstrate conformance with 10CFR50, Appendix R, are required to have a three-hour fire rating. Appendix R also requires that sufficient test documentation exist to verify the fire rating of the barrier. This places the plant in an unanalyzed condition since original installation in the 1984 to 1985 time frame because qualification data is not available to meet Appendix R criteria for PB 2105.

Physical Configuration of PB 2105

Based on a review of plant drawings and measurements taken of its exterior surfaces, along with information gained from a detailed examination of the internal contents, the following describes the pull box (PB).

PB 2105 is a box-shaped enclosure with overall dimensions of 47-1/2 inches wide by 35 inches high by 39 inches deep. The box, which is located behind and above the 1B auxiliary feedwater (AFW)[BA] pump [P], is constructed of one-inch thick marinite boards and is packed with cerafiber insulation [ISL]. The exposed surfaces of the box are coated with flamemastic. The box is internally divided into 16-inch high upper and lower sections by a one-inch thick marinite board with a sheet of 10-gauge sheet metal attached to the top of the board. The bottom of the box is 12 feet 11 inches off the floor, and the top of the box is 31-1/2 inches below the ceiling. The box is mounted on the north and east walls of the room, abutting the Technical Support Center (TCS) building and 1A AFW pump room respectively.

PB 2105 is framed internally with 2x2x1/4 inch steel angle irons. The 1-inch thick marinite boards are attached to the angle irons by #14 self-tapping screws. The internal dividing panel is attached to the angle irons with sheet metal screws. The angle irons abutting the TSC and 1A AFW pump room concrete walls are anchored to the concrete walls with ½ inch expansion anchors. There are also two 3x3x1/4 inch angle irons mounted vertically at the south wall of the box. One abuts the 1A AFW pump room, and is anchored to the concrete wall with ½ inch expansion anchors. The second extends through the top of the box and is welded to a steel plate mounted on the ceiling. This second angle iron is also coated with flamemastic where it extends outside the box.

PB 2105 Contents and Protection Provided

PB 2105 is an Appendix R fire barrier that contains cables routed from or through the 1A AFW pump room to the TSC. The box encloses two rows of three conduit stub outs in the reinforced

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

concrete walls of the 1A AFW pump room and the TSC. The conduit stub outs contain a total of 25 cables, 21 of which are required for Appendix R safe shutdown. The marinite board and sheet metal divider described above separates the two rows of conduit stub outs. Power cables are routed through the three conduit stub outs in the top row, and control cables are routed through two of the three conduit stub outs in the bottom row. The outermost stub out (i.e., closest to the south and west walls of the box) in the bottom row is spare.

Based on the physical location of conduit stub outs and cables within the box, at least ten inches of cerafiber is provided between the power cables routed through the top row of conduit stub outs and the sheet of marinite forming the top of the box. In addition, at least ten inches of cerafiber is provided between the control cables routed through the bottom row of conduit stub outs and the sheet of marinite forming the bottom of the box. Cables routed through the middle and innermost conduit stub outs on both rows are provided with at least ten inches of cerafiber between the cables and the sheets of marinite forming the walls of the box. The power cable routed through the outermost stub out (i.e., closest to the south and west walls of the box) in the top row is provided with a minimum of four inches of cerafiber between the cable and the sheets of marinite forming the walls of the box. The average density of cerafiber in PB 2105 is 12 pounds per cubic foot.

Fire Barrier Testing Issues

There are three acceptance criteria for fire tests conducted to determine the fire rating of fire barriers. The criteria are; (1) cold side temperature does not exceed 250 degrees F over ambient, (2) no spread of fire through the barrier, and (3) no projection of water through the barrier during the hose stream test. Fire testing is typically conducted to evaluate the capabilities of a wall, floor/ceiling assembly, and any penetration through the barrier to resist the spread of fire through the barrier. The three acceptance criteria are applied to the opposite side of walls and floor/ceiling assemblies. Fire tests are also conducted to evaluate the capabilities of an enclosure around cable trays or conduits to protect exposed cables within the enclosure. For a raceway enclosure, the three acceptance criteria are applied to the inside of the enclosure, with the cold side temperature applied to the surface of the exposed cable in the enclosure.

Kewaunee Nuclear Power Plant (KNPP) has had fire tests performed to verify the three-hour fire rating of a wall, floor/ceiling assembly, and any penetration through the barrier to resist the spread of fire through the barrier. The testing incorporated gypsum board wall and floor/ceiling assemblies, and penetrations through concrete or gypsum barriers sealed with cerafiber and

marinite board, or penetrations sealed with gypsum cement. However, KNPP has not had fire tests performed to verify a three-hour fire rating of a cerafiber and marinite board enclosure around cable trays or conduits to protect exposed cables within the enclosure. In addition, KNPP has not been able to locate any other fire tests that verify a three-hour fire rating of a raceway enclosure constructed similar to the construction of PB 2105.

From a review of the design change package that installed PB 2105, and based on personnel interviews, it appears that the fire testing performed for other penetration seal assemblies constructed of cerafiber and marinite board were used for the design of PB 2105. The differences between a penetration seal constructed of 12 inches of cerafiber with marinite board on both exposed surfaces, versus protection of cabling within a marinite enclosure provided with less than 12 inches of cerafiber, were not addressed as part of the design of PB 2105.

CAUSE OF THE EVENT

A root cause evaluation was initiated. However, it has not been completed. Although it is intended that the cause determination be completed and a supplement to this LER be submitted, only preliminary causes can be provided at this time. The principle causes appear to be; 1) personnel involved in the original design incorrectly assumed that test documentation for similarly constructed penetrations and barriers could be used as a basis for the installed design, and 2) later reviews of the "non-standard" barrier incorrectly applied the guidance of Generic Letter 86-10.

A review of the design modification packages that included PB 2105 did not locate any documentation to support the qualification of PB 2105. Consequently, it can only be speculated as to what was considered. It appears that the original designers may have assumed that since the pull box was being constructed of materials in a similar fashion to other penetrations and boundaries, that the PB design would also be acceptable. This is substantiated, in part, by 1984 correspondence between KNPP, and the contracted architect-engineering firm. We apparently did not recognize that the design configuration was unique and required specific test documentation.

PB 2105 was also identified as a non-standard fire barrier configuration in 1987. It appears that at that time the previously mentioned correspondence was reviewed which indicated that this configuration was developed and based upon previous available test reports. At the time, 1987, KNPP staff reviewed the information, and walked down the areas to ensure that the fire zone had not changed since the installation of the enclosure. In addition, a review of KNPP, Fire Protection Program Analysis (Fire Hazards Analysis) was performed with the walk-down, and an engineering evaluation was prepared in accordance with the criteria of Generic Letter 86-10 to evaluate the adequacy of the design to protect against the hazards in the area.

KNPP is continuing with a detailed root cause evaluation of this event to further determine any or all of the related causes.

ANALYSIS OF THE EVENT

This report is being submitted in accordance with 10CFR50.73(a)(2)(ii)(B), any event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety. The non-fire-rated construction of PB 2105 resulted in the

plant's failure to meet Appendix R requirements to ensure safe shutdown equipment availability in the event of a fire in the 1B AFW Pump Room.

The location and construction of PB 2105 have been assessed against the types, quantities, and locations of combustible materials in the 1B AFW Pump room. Based on the types of fires that could be expected, PB 2105 would be able to perform its intended function, which is to protect the cables routed through the enclosure from an exposure fire in the 1B AFW Pump Room. The bases for this conclusion are described below.

The primary combustible materials in the room are exposed cables in cable trays [TY], the electric motor [MO], and lubricating oil in the 1B AFW pump. Each is discussed separately below. The fire hazards associated with lubricating oil in the area fan coil unit [FCU] is bounded by the 1B AFW pump fire hazards since it contains a similar quantity of oil and is located further away from PB 2105 than the 1B AFW pump. As such, the area fan coil unit is not discussed further.

Cable Tray Exposure Fire Hazards

There are four stacks of cable trays in the room, with three stacks containing four trays and one stack containing five trays. (The stack of five trays actually contains six cable trays; however, the lowest tray is empty and is not discussed further.) The cable trays run east-west through the 1B AFW pump room, with two stacks of trays near the north wall and two stacks near the south wall of the room. Two of the stacks contain only power cables, and the power cables are all routed in galvanized steel interlocked armor, referred to as armored cable. The stacks with power cables do not present an exposure fire hazard.

The stack of cable trays closest to PB 2105 is about one foot to the south and contains only armored power cable. As such, this stack does not present a source of combustible material that could result in an exposure fire hazard to PB 2105. The next closest stack, which contains exposed control cables [CBL3], is about four feet south of PB 2105. The bottom tray in the stack of exposed control cable is 11 feet 6 inches off the floor, and the next lowest tray is 12 feet 9 inches off the floor. These are the only two trays that are below the bottom of PB 2105, which is located 12 feet 11 inches off the floor. Even though two of the trays in this stack are below the lowest PB 2105 elevation, direct flame impingement on the box would not occur if the cables caught fire The four foot separation and the shielding provided by the stack of trays containing armored cables would prevent direct impingement. The other two stacks of trays are located at least 15 feet south of PB 2105, and do not present a direct flame impingement exposure fire hazard to PB 2105.

An unmitigated cable tray fire could result in the formation of a hot gas layer that could challenge the integrity of PB 2105, if exposed to the hot gas layer for a sufficient time period. However, cable tray fires that result from a cable fault develop slowly and generate large

quantities of smoke. The smoke detector [DET] located at the south end of the 1B AFW pump would detect a fire in either of the two stacks of trays containing exposed control cables. This would occur well before a hot gas layer could bank down to the top of PB 2105, located 2-1/2 feet below the ceiling. Detection of the cable tray fire would result in fire brigade response and initiation of manual fire fighting activities within 15 minutes of detection based on typical response times during unannounced fire drills.

1B AFW Pump Fire Hazards

The 1B AFW pump is in a north-south orientation. The skid on which the pump is mounted is 12 feet 3 inches long. The electric motor is at the north end of the skid and the pump itself is at the south end. The skid is located 2 feet off the north wall to the TSC and about 4 feet off the east wall to the 1A AFW pump room. While not located directly under PB 2105, the north end of the skid is located about 1 foot west of PB 2105. Since the motor end of the pump skid is 2 feet off the north wall, and because PB 2105 extends about 4 feet south of the north wall, the motor end of the pump skid is located beside and below PB 2105.

The top of the motor is about 3-1/2 feet off the floor, or over 9 feet below the bottom of PB 2105. A failure of the motor could result in a fire with a peak heat release rate of up to 70kW based on EPRI data. A 70-kilowatt (kW) motor fire would not result in a plume or hot gas layer temperature to result in damage to exposed qualified cable at the elevation of PB 2105. As such, a motor fire would not challenge the integrity of PB 2105 and would not result in ignition of cables in the stack of cable trays containing exposed control cables.

The pump itself contains 5 gallons or 19 liters of lubricating oil. While additional lubricating oil may be introduced into the location during maintenance activities, additional oil is transported in approved safety cans and would not represent an additional source of combustible material for a postulated fire.

There is a dike under the pump and motor assembly skid for collection of any oil leaks from the pump. The dike is sloped from north to south, dropping about 2 inches over the 11-foot length of the dike. A drain [DRN] line out of the south end of the skid is piped to the floor drain waste system just south of the pump skid. (The recirculating water for the lube oil cooler [CLR] is piped to the same floor drain.) Potential leaks from the oil reservoir at the south end of the skid when the pump is not operating would be collected in the dike and would flow directly to the drain line to the floor drain waste system.

The pump bearings at the south end of the pump are lubricated when the pump is operating. An auxiliary lube oil pump provides bearing lubrication for pressures between 10 and 15.5 psig. Above 15.5 psig, the shaft driven lube oil pump provides the required bearing lubrication. Lubricating oil circulates through the shell side of the oil cooler, which is provided with cooling water flow from the pump recirculation flow.

The auxiliary lube oil pump, the lube oil cooler, and interconnected piping are outside the diked area on the 1B AFW pump skid. These are the primary locations where oil spills could occur outside the diked area and pool on the floor. Such spills would only be postulated when the pump was running, which would be during periodic testing, during normal plant heatup and cooldown operations, and when the main feedwater (FW)[SJ] supply to the steam generators is interrupted.

The typical heat release rates for lubricating oil is on the order of 1538 kilowatts (kW) per square meter (m^2) of the spill. The net heat of combustion for lubricating oil is on the order of 46,400 kilojoules (kJ) per liter. A five-gallon or 19 liter pool of lubricating oil would have a diameter of about 10 feet or 3.05 meters at a depth of 0.1 inches or 2.5 millimeters. With a pool diameter of ten feet or 3.05 meters, the area of the spill would be about 78 square feet, or 7.2 square meters. The peak heat release rate of the fire would be equal to 1538kW/m^2 times 7.2m^2, or 11,074kW. The total energy that could be released in a 19-liter pool fire would be equal to 46,400kJ/liter times 19liters, or 881,600kJ. The duration of such a fire would be equal to 881,600kJ divided by 11,074kW, or about 80 seconds. If the pool diameter were five feet or 1-1/2 meters, with an area of 19.6ft^2 or 1.8m^2, the fire duration would be 881,600kJ divided by 2768kW (1538kW/m^2 times 1.8m^2), or under 5-1/2 minutes.

In order to impact directly on PB 2105, such a pool would have to spread to the immediate vicinity of PB 2105. The auxiliary lube oil pump is located on the southeast side of the pump skid, over 8 feet south of PB 2105. The lube oil cooler is located on the southwest side of the pump skid. An oil spill from the lube oil cooler would have to spread 9 feet north to reach the end of the pump skid, and also spread 5 feet east, in order to reach PB 2105. Based on these distances, neither a 5-foot nor a 10-foot diameter pool fire would result in direct flame impingement on PB 2105.

A pool oil fire could be postulated that would result in ignition of the exposed control cables in the stack of cable trays located 4 feet south of PB 2105. The oil fire would generate a lot of smoke, which would activate the smoke detector located over the south end of the pump. As previously identified, activation of the smoke detector would result in fire brigade response and initiation of manual fire fighting activities within 15 minutes of detection based on typical response times during unannounced fire drills.

Conclusion

Postulated fires in the vicinity of PB 2105 would have a minimal impact on PB 2105 and the cables routed through it. The bases for this conclusion are summarized below.

- A fire in the nearest exposed cables would not result in direct flame impingement on PB 2105 due to the 4-foot separation between of the trays and PB 2105, and the shielding provided by the stack of armored power cables located between the two.

- A 70kW electric motor fire would not result in direct flame impingement on PB 2105, and would not result in the ignition of the exposed cables in the overhead cable trays.

- A lubricating oil spill that occurs when the pump is not operating would be contained in the diked area on the pump skid. The spill would flow south away from PB 2105 and would drain out the south end of the skid to the floor drain waste system.

- A lubricating oil spill that occurs when the pump is operating would not spread far enough to result in direct flame impingement on PB 2105. However, a lubricating oil spill could be postulated that would result in the ignition of exposed control cables in overhead cable trays. As previously identified a cable tray fire would not result in direct flame impingement on PB 2105.

- Postulated pool oil and/or cable tray fires would activate the ceiling-mounted smoke detector that is located above the south end of the pump, in between the two stacks of cable trays containing exposed control cables. Activation of the smoke detector would result in fire brigade response and initiation of manual fire fighting activities within 15 minutes of detection based on typical response times during unannounced fire drills.

Test Results

On April 27, 2001, a test of the pullbox design was completed at Underwriters Laboratory (UL) in Northbrook IL. The test was performed using the guidance provided by NFPA 251, "Standard Methods of Fire Endurance Testing of Buildings and Construction Material." NFPA 251 was followed whenever practical. The pullbox design was tested in the UL column furnace. Since, sufficient time was not available for construction, curing, and aging of the concrete slabs, in lieu of the concrete slabs, 11/2 to 2 fire rated hour gypsum wall was used. The results of the test in the column furnace were used to determine the actual fire rating of the configuration of the pullbox.

Pullbox 2105 was disassembled and internal dimensions and configurations were documented. A pullbox identical to pullbox 2105 was then constructed at UL with thermocouples placed inside the box in accordance with the guidance provided by GL 86-10 supplement 1. The following acceptance criteria were established:

1. Cold side Temperature had to remain less than 326 (250 degrees plus ambient temperature of 76).

2. Flame of gas hot enough to ignite cotton waste could not propagate into the box.

3. The box could not allow water intrusion under the hose stream test.

The following provides the results of the test:

1. Highest cold side temperature was 193 at 61 minutes into the test.
2. There was no flame propagation into the box.
3. The box remained structural intact during the performance of the hose stream test

Based on these results, we have concluded that pullbox 2105 was capable of achieving a fire rating of 60 minutes. An analysis of the combustible in the area determined a maximum fire loading of 30 minutes. Therefore, the box provided adequate fire protection for the hazard in the area.

Risk Assessment

All though the NMC has concluded that a credible fire would not damage the cables in the pullbox, a probabilistic risk assessment was performed. Based on our deterministic analysis, the only credible fire that could damage the cables occurs from a rupture of the AFW pump lube oil system. The following provides a summary of our analysis.

EPRI TR-102266 provides a methodology to calculate a pipe failure frequency for any safety-related piping based on number of pipe segments. The figure used here is for 0.5" - 2" safety-related piping in pressurized water reactor power plants. The heat exchanger rupture frequency is from NUREG/CR-4639. The failure can only occur when AFW pump 1B is running, since this is the only time the oil lines are pressurized.

The frequency of pipe rupture is:
FR = (FRS * NS + FHXR) * FPR * CF
FR = Frequency of rupture per year
FRS = Frequency of rupture of a segment per hour = 7.09×10^{-10}/segment-hour
NS = Number of pipe segments = 13
FHXR = Frequency of heat exchanger rupture per hour = 3.95×10^{-8}/hr
FPR = Fraction of time the pump is running = 7.19×10^{-3} based on the last 5 years of plant operation
CF = Conversion factor between hrs and years = 8760 hrs/year

The frequency of a rupture per year is then 3.07×10^{-6}/year.
If we assume:

- A 1.0 probability that the oil ignites and causes the cable in the cable trays to ignite,
- A 0.5 probability that convection or radiation from the cable trays challenges the box (Based on a mean value with maximum uncertainty),
- A 0.1 probability of failing to manually suppress the fire within 60 minutes (Based on the EPRI Fire

PRA Implementation Guide)
The increase in core damage frequency is:
3.07×10^{-6}/yr x 1.0 x 0.5 x 0.1 = 1.53×10^{-7}/yr

There are several conservatisms in this analysis.

- It is assumed that the oil will ignite and that the fire will be sufficient to ignite the cable trays.
- Even though it is highly unlikely that convection or radiation from the trays would challenge the pullbox, a 0.5 probability is assumed.
- The data used includes pipe breaks and heat exchanger ruptures of all pressures; the AFW pump lubricating oil system is at only 15 psig.
- All cables in the cable trays and the pullbox are assumed to be damaged if the damage threshold for any is reached.
- Restoration of equipment is not considered.

Since the increase in core damage frequency due to the pullbox being unqualified is < 1×10^{-6}, the event has very low safety significance

CORRECTIVE ACTIONS

Immediate actions were to implement compensatory measures according to the KNPP fire plan. A roving fire watch was initiated and will remain in effect until a qualified 3-hour fire rated barrier is provided to protect the cables in PB 2105.

A fire hazards review was performed to determine whether the box was capable of protecting internal cables considering the potential for fire exposure. The design was judged acceptable for at least one hour. This was judged to be a sufficient time to identify and combat the fires postulated to occur in the 1B AFW pump room before damage to the cables would occur.

A design change has been initiated to design and install a qualified three hour fire rated Appendix R barrier.

PB 2105 was dismantled to obtain direct examination data. The pull box was reassembled according to original design after the direct examination data was gathered. During the time the box was disassembled a continuous fire watch was stationed in the 1B AFW pump room.

The direct examination data was gathered to fabricate a facsimile pull box. The facsimile box was tested at the Underwriters Laboratories (UL) in Northbrook, Illinois. The testing was performed in order to quantify the structural capabilities of the actual configuration, and to determine the temperature rise inside the box in the location of existing cable.

Since the root cause evaluation of the improper design application continues, it is possible that

further corrective actions may be determined to be necessary. In addition, since the UL test results are not available at the time the LER was developed, a Supplemental LER will be submitted. Any additional corrective actions that may be proposed will be identified with the supplement.

ADDITIONAL INFORMATION

This event is not identified as a safety system functional failure as defined in NEI 99-02, Revision O, dated March 2000. Fire Protection support consultants (Fire Protection Engineers) and plant Engineering staff have evaluated the pull-box design and have concluded that the box will protect the enclosed cables considering the fire exposure from the room. Their evaluation of the materials and their configuration are such that the box will protect the enclosed cables for a minimum of one hour. This is enough time for the fire brigade to respond to the fire and suppress the fire. This will ensure continued operability of the equipment protected by the pull-box. Therefore, it is reasonable to assume that the fire will be extinguished before damage will occur that would result in a failure of the equipment being relied upon to shutdown the plant.

SIMILAR EVENTS

None