NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
THREE MILE ISLAND, UNIT 1	50-289	1 OF 6

TITLE (4)
Inoperable Fire Dampers

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	16	98	98	-- 005 --	01	07	14	98	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N
POWER LEVEL (10)	100 %

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

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

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
W. G. HEYSEK, TMI LICENSING ENGINEER	717-948-8191

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
D	VL	BDMP		N						

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	NO N				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On April 16, while the plant was operating at 100% power, the Plant Review Group evaluated a condition with regard to the operability of fire dampers AH-FD-64 and AH-FD-74 that resulted from information gathered during maintenance on the dampers and determined that the plant had been operating outside its design basis. The fire dampers were determined to be inoperable in that they were unable to close on either an actuation signal from their respective combustible gas detectors or from the heat of a fire as designed.

The deficient condition was determined to exist from September 23, 1996 until both AH-FD-64 and AH-FD-74 were manually closed, placing them in their fail safe design basis position on March 25, 1998. The dampers were restored to their normal configuration and were in operable condition following satisfactory completion of post maintenance testing on April 8, 1998.

The cause of the inoperability of the dampers was determined to be the improper re-installation of an "S" link (a component of the damper trip mechanism configuration) following a mechanical functional test of the dampers on September 23, 1996. Inadequate or incomplete procedural instruction was identified as the root cause of the improper installation of the "S" links.

The event is being reported per 10 CFR 50.73(a)(2)(ii)(B).

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

I. PLANT OPERATING CONDITIONS BEFORE THE EVENT

The plant was operating at 100% power at the time the condition was determined to be reportable and was not changed as a result of that determination.

II. STATUS OF STRUCTURES, COMPONENTS OR SYSTEMS THAT WERE INOPERABLE AT THE START OF THE EVENT AND THAT CONTRIBUTED TO THE EVENT.

None

III. EVENT DESCRIPTION

On April 16, the Plant Review Group (PRG) met to review new information regarding the March 19, 1998 as found condition of the trip mechanisms on fire damper AH-FD-64 and AH-FD-74 [VL/BDMP] and to determine the status of the dampers with respect to their operability and the reportability of the condition based on that information. It was identified that the dampers failed to close on March 16, 1998 during functional testing of the combustible gas detector actuation setpoint because the trip mechanism linkage was misconfigured. An "S" link (a component of the trip mechanism linkage) was incorrectly inserted in the trip mechanism and as a result, the dampers were rendered inoperable. The condition was determined to exist from September 23, 1996 when the dampers were manually tripped and the trip mechanism linkage was not reconfigured in accordance with the drawing and procedural instructions. It was determined by the PRG that the conditions had been resolved following the satisfactory testing of the equipment on April 8, 1998. AH-FD-64 and AH-FD-74 had been inoperable since September 23, 1996 and this was a condition outside the plant's design basis and thus reportable under 10 CFR 50.73(a)(2)(ii)(B).

Dampers AH-FD-64 and AH-FD-74 are three hour rated, Ellis & Watts model DAF-6 dampers, each about 28" square. They are mounted directly onto the inside of a FHB exterior wall. A reusable McCabe fire/smoke ETL Model E-5720 (the damper trip mechanism) is mounted on one of the two blades that make up each fire damper. They are the only two dampers of their type in the plant. Their purpose is to isolate the interior of the Fuel Handling Building (FHB) from the exterior in the event of a plane crash in the vicinity of the FHB. The fire dampers are designed to close on indication of high hydrocarbon combustible concentration and/or the heat of a fire.

IV. FAILURES AND ERRORS

On September 23, 1996 AH-FD-64 and AH-FD-74 were functionally tested to confirm they would close. Closure is tested by disconnecting the dampers from their actuation linkage and then observing if the dampers would fully close. Upon satisfactory completion of the closure test, the dampers are reopened and the trip mechanism is re-latched.

During the afternoon of March 16, 1998 while I&C Technicians were performing calibration of combustible gas detectors AH-CE-775A and B [VL/DET], they identified that the associated fire dampers (AH-FD-64 and AH-FD-74) failed to close when the combustible gas detectors reached their trip set point. The result was identified as a deficiency on the preventive maintenance data page and noted in the I&C Logbook. In addition the Control Room was informed. The Control Room contacted the Fire Protection Engineer (FPE), who was at home and questioned him regarding the failure of the dampers to close on actuation by the combustible gas detectors. He incorrectly advised that the dampers were still operable since the bi-metalic portion of the damper trip mechanism linkage would react to the heat of a fire and close the dampers. The initial operability concern was allayed at that time based on 1) the FPE's explanation and 2) the ESF ventilation system was not in operation, nor required to be operable.
Late in the afternoon of March 19, 1998 while an I&C Technician and Supervisor were reviewing the next day's work, they identified that the damper closure problem was not with the detector or its electrical connection to its electro-thermal link (ETL) but rather with the make-up of the trip mechanism linkage at the damper. Having a damper detail drawing in hand, the technician pointed out that the "S" link (a component of the trip mechanism linkage) had not

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

been inserted in accordance with the drawing on both AH-FD-64 and 74. In this as found condition, the linkage would not release when actuated by the combustible gas detectors.

A Corrective Action Process (CAP) form T1998-0181 was initiated by the I&C Foreman at 3 P.M. on March 19, 1998 to document the problem and corrective actions associated with its resolution. While CAP form T1998-0181 identified that the "trip mechanisms were improperly engaged". The CAP was focused on correcting the drawing's potential legibility problem and was prioritized based on that work. The Operations Review comments section of the form was completed to reflect a discussion of operability with the FPE and Operations Director. It stated that the dampers were operable since they would close due to the heat of a fire.

Research into maintenance history identified that dampers AH-FD-64 and AH-FD-74 were last tested on September 23, 1996 when Utility Department personnel performed procedure U-11 "Fire Damper Functional Test". The best information available leads to a determination that during the performance of that activity, the "S" links were not left configured in accordance with direction provided by the procedure or the diagram it contained.

On the morning of March 20, while the I&C Technician was obtaining permission to perform the work, he informed the Shift Supervisor that the dampers were inoperable. This statement was inconsistent with the response obtained from a direct question from the Shift Supervisor to the Lead I&C Foreman earlier that morning and with the previous operability determination documented on CAP T1998-0181 initiated the previous day. However, a logbook entry addressing the damper inoperability was not initiated.

Corrective maintenance to properly install the "S" link on the trip mechanisms was completed on March 20, 1998. The functional testing to assure damper closure as a result of the combustible gas detector reaching its actuation setpoint was performed on that date. Damper AH-FD-74 closed satisfactorily and was considered operable but the closure of AH-FD-64 was hampered by the interference with the ETL flexible conduit which inhibited consistent full closure and latching of one of the fire damper's two vanes during testing on March 20, 1998. The I&C Technician noted in the I&C Logbook that closure of the left vane of Damper AH-FD-64 is hampered by insufficient flexibility in the BX conduit. An Engineering Work Request was initiated to investigate the problem but a CAP was not initiated and an operability determination was not made.

Between March 20 and 25, 1998 there were numerous opportunities to identify the failure to question the operability of AH-FD-64 during review of the I&C Logbook, but none resulted in questioning the significance of the March 20 entry regarding damper AH-FD-64.

On March 25, a Fire Service System Engineer (FSSE), in response to a reported problem with damper AH-FD-64, began researching information on the design of the damper. Upon reading the I&C Logbook entry, he determined that the damper was incapable of fulfilling its intended safety function and was therefore, considered inoperable. The FSSE informed the Shift Supervisor of the inoperable condition of AH-FD-64. In accordance with the fire protection program, immediate corrective action was taken to establish a continuous fire watch in the area within an hour. CAP T1998-0194 was initiated shortly thereafter. Both dampers were manually closed (AH-FD-74 as a conservative action since it was not affected by the interfering conduit) and the fire watch was secured.

A PRG meeting (98-32) was convened on March 26, 1998 to perform an operability and reportability determination on the fire damper closure interference issue. It was determined that although the damper was not operable, the condition was not 10 CFR 50.73 reportable because the nonconforming condition had been resolved in accordance with the TMI Fire Protection Program. PRG requested, however, that a voluntary LER be submitted because the requirements of the TMI Fire Protection Program as defined in Administrative Procedure 1038 had not been adhered to: compensatory actions had not been put in place on March 20, 1998 when it was identified that the flexible conduit had rendered the fire damper AH-FD-64 inoperable.

During the preparation of the voluntary LER, the misconfigured trip mechanism linkage problem, found on March 16, 1998 was recognized as an unaddressed operability issue. Recognizing this situation to be different than that previously reviewed by the PRG, the FSSE informed the PRG Chairman of the new information on April 16, 1998. A second PRG meeting (98-36) was held on April 16, 1998 at which it was determined, after reviewing NUREG 1022 and the chronology of events, that the misconfiguration of the trip mechanism linkage had put the plant outside its design basis from September 23, 1996 until March 25, 1998 when the dampers were manually closed. Operating in a condition outside the design basis of the plant is reportable under 10 CFR 50.73 (a)(2)(ii)(B).

The design basis for operation of dampers AH-FD-64 and AH-FD-74 has been found to be not well understood. The dampers are designed to close either in response to high hydrocarbon levels (resulting from a plane crash in the vicinity of the FHB) on the combustible gas detectors or the heat of a fire on the bi-metalic portion of the damper trip mechanism linkage. Due to their association with this accident scenario, the dampers are required to be operable at all times; not just when the ESF ventilation system is in operation.

A root cause evaluation was performed in accordance with Human Performance Effectiveness System (HPES) methodology in response to the March 25, 1998 discovery that AH-FD-64 had been inoperable since March 20, 1998. The purpose of the root cause evaluation was to determine why an operability determination was not made when it was identified on March 20, 1998 that AH-FD-64 closure was impaired. The root cause evaluation determined that a questioning attitude was not evident during the evolution of this event. The design basis of the dampers was not adequately researched by Operations personnel in response to the events of March 16, 1998 and on March 20, 1998 the inoperability of damper AH-FD-64 was also not recognized. Maintenance personnel did not question the inappropriateness of leaving the improperly configured trip mechanism linkage as it was found until repairs were scheduled to be performed. Others, including management personnel, who had reviewed the I&C Logbook between March 20 and March 25, 1998, failed to question the note addressing the fact that the fire damper did not fully close and make a connection between damper operability and design basis or fire watch requirements.

By not utilizing the Corrective Action Process on March 20, 1998 to identify the interference problem between the flexible conduit and the vane of AH-FD-64, management was not made aware of the deficient condition of the damper in a manner that would have resulted in an earlier determination of operability.

The cause of the inoperability of dampers AH-FD-64 and AH-FD-74 was the improper re-installation of the "S" link in the damper trip mechanism on September 23, 1996. A root cause evaluation was initiated in accordance with Human Performance Improvement Process (HPIP) methodology to determine the root cause of the installation error. It involved both a documentation review and interviews with plant personnel who were involved with the task.

Upon completion of the root cause evaluation, inadequate or incomplete procedural instructions was identified as the root cause of the damper inoperability. A review of the historic procedure used to perform the task in 1996 identified that insufficient direction was provided to the workers to assure that the task to install the "S" links would be properly installed.

V. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THE EVENT

TMI-1 was outside of its design basis due to the inability to automatically actuate and close the fire dampers AH-FD-64 and AH-FD-74. Neither the detection of high hydrocarbons in the event of a plane crash in the vicinity of the FHB penetration or the heat of a fire would have closed the dampers as designed. The condition existed from September 23, 1996, when the "S" links were incorrectly installed, until March 25, 1998, when the dampers were manually closed to compensate for the mechanical interference between the flexible conduit and the damper's closing vane.

Per section 2.4.2.5 of the FSAR, "Critical ventilation openings are protected against the effects of fuel or fire. The probability of 2.2×10^{-7}/per year represents the chance that fire or fuel will occur in the immediate vicinity of the openings." In the event of a plane crash in the area, the combustible gas detectors would have alarmed in the Control Room as well as attempted to trip the fire dampers closed. Alarm PLF-2-9 in the Control Room would actuate if combustible gas was detected from AH-CE-775A/B. The alarm response procedure requires that ESF ventilation be secured and that samples be taken at the spent fuel pool area and ESF ventilation exhaust point for combustible gas or vapor. The damper blades are visible from the operating floor of the Fuel Pool and are accessible for manual closure if required. No equipment in this area of the Fuel Handling Building is required for safe shut down. If a fire were present Emergency response procedure 1202-31 "Fire" would dispatch fire brigade members to the scene of a fire.

VI. PREVIOUS EVENTS OF A SIMILAR NATURE

These dampers and their trip closure mechanisms are the only two of their type in use at the plant. A records review has found no previously identified failure of either of these dampers to function due to an interference or improper installation of the "S" links. All previous visual inspections and functional tests were performed satisfactorily.

However, failure of personnel to exhibit a "questioning attitude" was identified in a prior retracted LER (97-006). In that instance, individuals involved with the repair of one component failed to consider the possibility of the deficient condition to exist on one or both of the other like components. In this instance, as previously stated, it was also determined that a questioning attitude was not evident during the evaluation of why an operability determination was not made when it was identified that AH-FD-64 closure was impaired. Although the events were not of a similar nature, the similarity of cause was considered adequate reason to initiate a corrective action. See the intermediate completed corrective action item below.

VII. CORRECTIVE ACTIONS

Immediate/Completed Corrective Actions:

1. The damper trip mechanism was properly installed during the re-performance of the functional testing steps of preventive maintenance related Job Order 149279 on March 20, 1998.

2. Fire dampers AH-FD-64 and AH-FD-74 were manually closed on March 25, 1998 until the mechanical interference with the flexible conduit could be evaluated and rectified.

3. The mechanical interference with the flexible conduit which prevented the complete closure of one of the vanes of AH-FD-64 was corrected by relocating the mounting point of the Electro-Thermal Link to provide additional clearance between its flexible conduit and the damper frame. This activity was completed on April 8, 1998.

4. Management expectations with regard to a "questioning attitude" in making decisions associated with operability and reportability issues have been promulgated to Control Room personnel through a revision to Operations Memo 98-01 which contains a new section concerning operability determinations. This action was completed on May 14,1998.

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Intermediate Term Completed Corrective Actions:

1. The root cause evaluation performed to identify the root cause for the failure to properly install the "S" links in the damper trip mechanisms was completed on June 11, 1998. The root cause was determined to be a failure to follow procedures correctly because the graphics were less than adequate. Long term corrective action number 2 was initiated to correct the procedural deficiencies identified in Surveillance Procedure 1303-12.23 by this root cause evaluation.

2. A review of the Corrective Action Process was performed to determine if there was evidence of inconsistent application of the process throughout the organization supporting the operation of TMI-1. This review did not find evidence of a trend.

3. Improving the use of the Corrective Action Process throughout the organization supporting the operation of TMI-1 will be accomplished through feedback on use of the system and a reinforcement of management expectations. This was initiated in June 1998.

Long Term Corrective Actions:

1. To familiarize personnel with the circumstances of the damper condition, all licensed operators, appropriate Engineering and Maintenance personnel will be required to read this LER within sixty days (July 17, 1998) of its submittal. The purpose of this action is to emphasize how the unique design basis of these two fire dampers and their combustible gas detectors as installed in the ESF ventilation system lessened the perceived urgency of the problem once it was identified.

2. Surveillance Procedure 1303-12.23 will be revised to 1) include the design basis for the gas detectors and dampers in its "Purpose" section, 2) a functional actuation of the trip mechanism by the gas detector will be required to prove functionality of the damper and 3) provide additional clarity to directions for making up the damper trip mechanism linkage; specifically addressing the proper location of the "S" link. The procedure revisions will be completed by August 1, 1998.

3. Management expectations with regard to review of logbook (Plant Operations and Maintenance Shop) entries will be discussed and/or promulgated to individuals performing the reviews. The action will be completed by August 1, 1998.

* The Energy Industry Identification System (EIIS), System Identification (SI) and Component Function Identification (CFI) Codes are included in brackets, "[SI/CFI]", where applicable, as required by 10 CFR 50.73(b)(2)(ii)(F).