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AUTH.NAME AUTHOR AFFILIATION
ALEXICH,M.P. Indiana & Michigan Electric Co.
RECIP.NAME RECIPIENT AFFILIATION
DENTON,H.R. Office of Nuclear Reactor Regulation, Director

SUBJECT: Responds to 840404 request for addl info re util request for exemption from requirements of App R to 10CFR50 concerning nine floor hatches requiring fire protectin.Drawings provided.

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Office of Nuclear Reactor Regulation, Director

SUBJECT: Response to [illegible] request for addl info re util request for exemption from requirements of App R to 10CFR50 re [illegible] fire floor [illegible] requiring fire protection [illegible] provisions.

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TITLE: OR Submittal: Fire Protection

[illegible]

[illegible]

INDIANA & MICHIGAN ELECTRIC COMPANY

P.O. BOX 16631
COLUMBUS, OHIO 43216

June 27, 1984
AEP:NRC:0692P

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
INFORMATION CONCERNING REQUEST FOR TECHNICAL EXEMPTIONS
FROM REQUIREMENTS OF APPENDIX R TO 10 CFR 50 FOR FLOOR HATCHES

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

This letter completes our response to your request of April 4, 1984 for additional information on our request for exemption from the requirements of Appendix R to 10 CFR Part 50 with regard to nine (9) floor hatches which require fire protection. Six (6) of these hatches require 1 1/2 hour fire protection and three (3) require a 3 hour fire protection rating. We requested a technical exemption for these hatches because fire rated hatches were not commercially available. To the best of our knowledge, to date, no floor hatch has been subjected to any test criteria which would result in a fire rating.

In our AEP:NRC:06920 letter dated June 15, 1984, we provided drawings and sketches, a description of the added insulation, including how it is to be applied, and sketches which identified the movable parts and unprotected areas of the hatches.

Attachment 1 to this letter provides additional drawings which further define the method of installing the insulation.

Attachment 2 presents the results of heat transfer calculations and other relevant information associated with the 6 Bilco supplied hatches and 3 field fabricated hatches.

In your letter of April 4, 1984, you requested information on any alternatives to the insulation and compensatory measures that may be available. We have provided a brief discussion in Attachment 2 of qualitative considerations regarding the hatches

A006
1/1

which in part may be considered compensatory measures. We have considered alternative measures such as putting an insulating blanket above as well as below the hatch, and/or utilizing different insulating material. In all cases our conclusions were that it could not be done either because of equipment interference, weight restrictions, and/or hatch operability. We believe the total level of fire protection provided in the affected areas as described in Attachments 1 and 2, is adequate.

This letter has been prepared following Corporate procedures which incorporate a reasonable set of controls to insure its accuracy and completeness prior to signature by the undersigned.

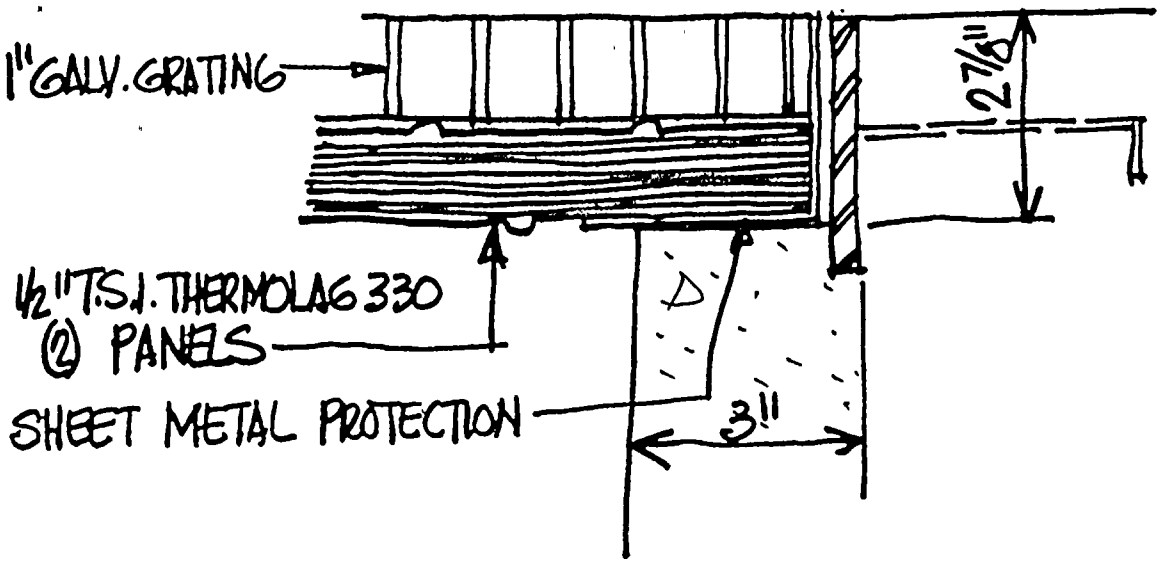
Very truly yours,

M. P. Alexich
Vice President

MPA/cm

cc: John E. Dolan
W. G. Smith, Jr. - Bridgman
R. C. Callen
G. Charnoff
E. R. Swanson, NRC Resident Inspector - Bridgman

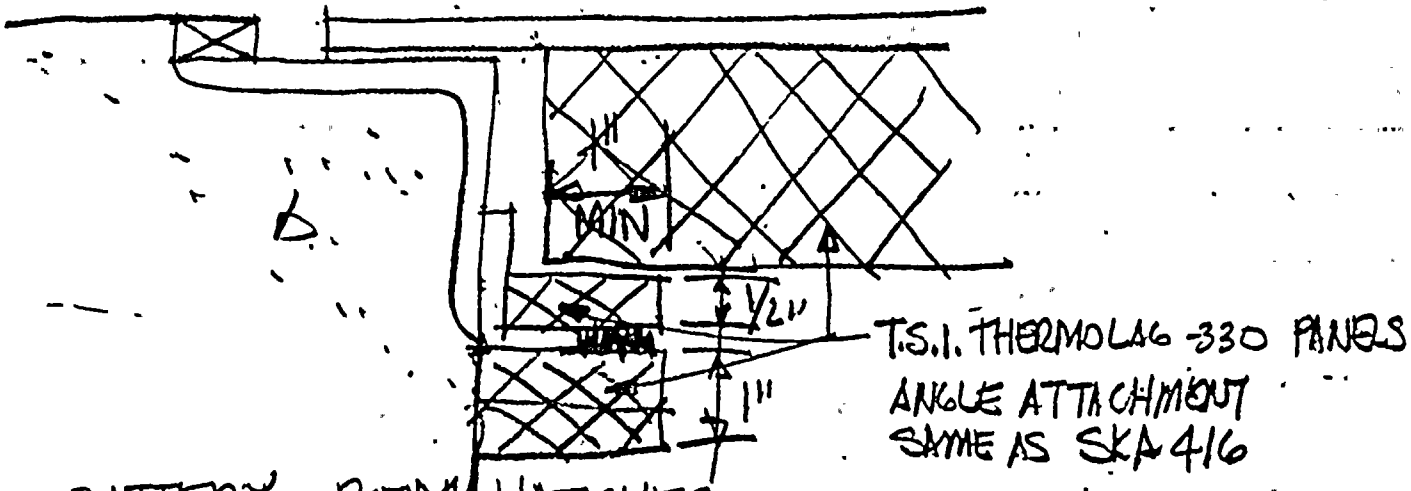
ATTACHMENT 1



SCREEN HOUSE HATCH DETAIL

D.C. COOK NUCLEAR PLANT

SKA 414
6/26-4



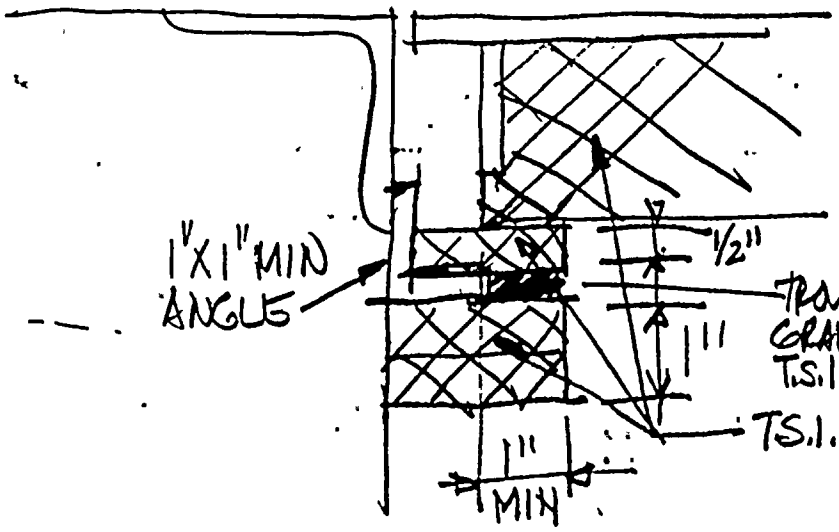
BATTERY ROOM HATCHES

D.C. COOK PLANT

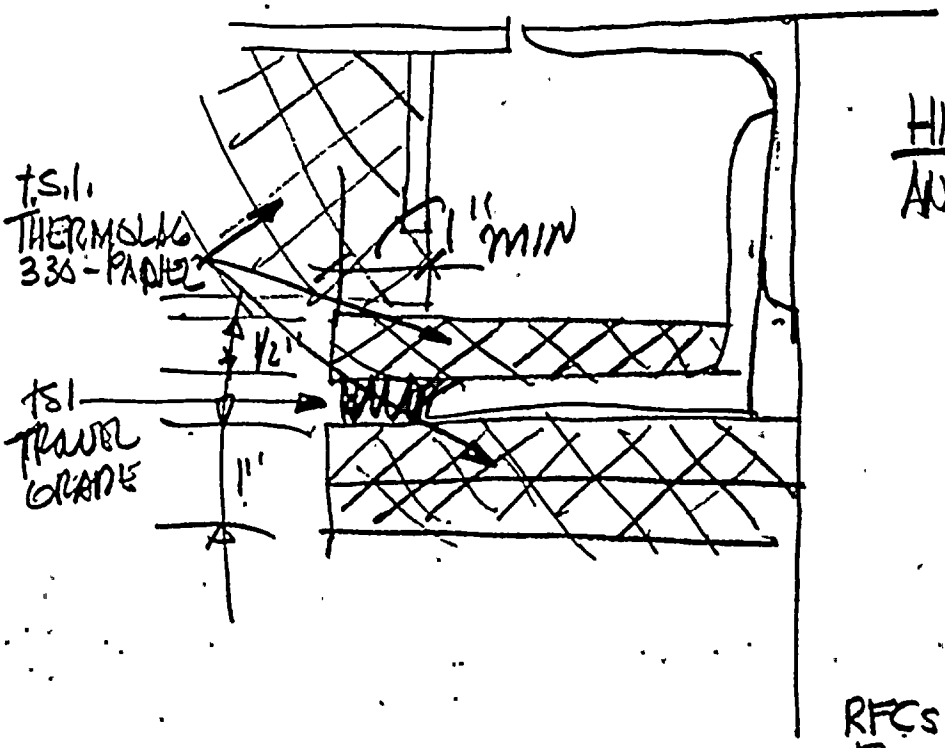
RFCS 01-2676 & 02-2692 SKA 415 6/26/89

84 V.D.F./ACM

J. HOSS - COOK PLANT
T.R. ADAMS - COOK PLANT
S. FOX
V. LEPORE
C. OLSEN
B. GERWE
W RIGG



THREE SIDES
ANGLE ATTACHMENT
① WELD –
② 1/4" EXPANSION ANCHORS
(3 MIN. EA SIDE)
(2" MIN. EMBEDMENT)



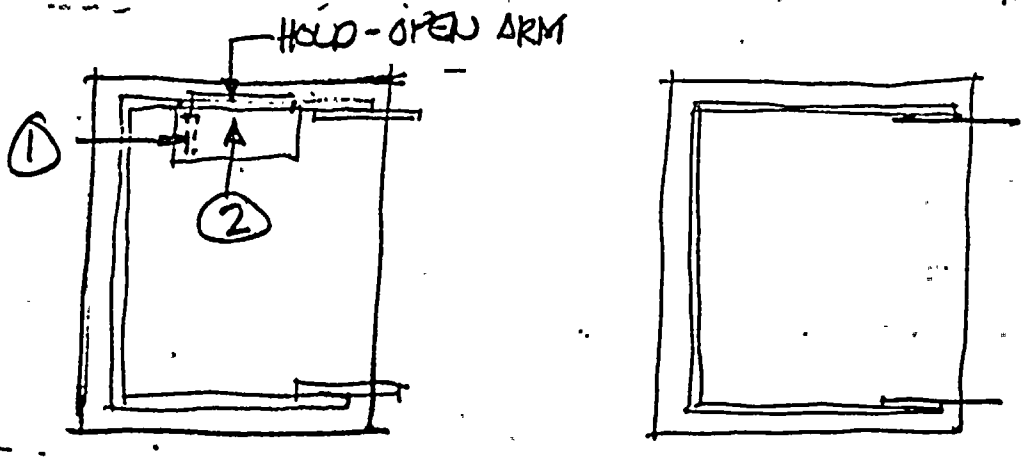
HINGE SIDE
ANGLE ATTACHMENT
SAME AS ABOVE

RFCs 01-2676 & 02-2672
BILCO FLOOR HATCHES
D.C. COOK PLANT
SKA 416 6/26/84
BY U.O.F./ACM

FLOOR HATCH NOTES SKA 417 6/26/84

D.C. COOK PLANT
RFCS 01-2676 & 02-2692

BY V.D.F./KCM



1. REMOVE HANDLE & MODIFY HOLD-OPEN ARM FOR OPERATION
2. FILL IN OPEN SPACE W/ T.S.I. MATERIAL
3. TROWEL GRADE T.S.I. MATERIAL APPLIED TO OPEN SPACES
4. HINGES TO BE PROTECTED WITH T.S.I. (1" MIN.)
5. REMOVE LIMIT SWITCH STOP & RELOCATE (FILL SPACE W/ T.S.I MAT'L) (TO ELIMINATE PREVIOUSLY ASSUMED "HOT-SPOT")
6. RELOCATE CO_2 ISOLATION SWITCH
7. LATCH HAS BEEN REMOVED - ELIMINATES PREVIOUSLY ASSUMED "HOT-SPOT"
8. REMOVE LATCH - FILL SPACE W/ T.S.I. MATERIAL
9. CERAMIC BLANKET AS FILL MAT'L BETWEEN T.S.I. PANELS IN BATTERY ROOM HATCHES
10. CERAMIC BLANKET AS FILL MAT'L BETWEEN T.S.I. PANELS & STEEL HATCH COVERS (BILCO)
11. FILL CONC. VOIDS W/ GROUT
12. BOX-IN AND SEAL BALANCE MAGNETIC SWITCH (BMS.)
13. REMOVE GYPSUM PANEL FOR SIDE ANGLES & T.S.I. MAT'L.
14. INSTALL NEW FOLD-DOWN HANDLE

D.C. COOK PLANT
RFCS 01-2676 & 02-2692

CONTROL ROOM UNIT-1 HATCH NOTES

(SEE SKA 417)

1
2
3
4
5
6
7
10
11

CONTROL ROOM UNIT-2 HATCH NOTES

(SEE SKA 417)

1
2
3
4
5
6
7
10
11

D.C. COOK PLANT
RFCs 01-2676 & 02-2692

UNIT-1 4 KV SWITCHGEAR ROOM - SPREADER RM. HATCH NOTE
(SEE SKA 417)

1
2
3
4
8 *
10
11
12

UNIT-2 4 KV SWITCHGEAR ROOM - SPREADER RM. HATCH NOTE
(SEE SKA 417)

1
2
3
4
8 *
10
11
12

UNIT-1 RAD PROTECTION TO INTERMEDIATE VAULT HATCH NOTE
(SEE SKA 417)

1 * (HANDLE HAS BEEN REMOVED)
2
3
4
7
10 *
11 * (TO BE CHECKED)
12
13

UNIT-2 ELEV 633'-0" TO INTERMEDIATE VAULT HATCH NOTES
(SEE SKA 417)

1
2
3
4
8
10
14 (SEAL HOLES OF EXIST. HANDLE W/ T.S.I. MAT'L)
11

UNIT-1 BATTERY RM. HATCH NOTES (SEE SKA 417)

9

11

UNIT-2 BATTERY RM HATCH NOTES (SEE SKA 417)

9

11

SCREEN HOUSE HATCH NOTE

STRESS SKIN TO BE ON OUTSIDE ON DWG. 12-3764
SMOOTH SURFACE ON T.S.I. MATERIAL AGAINST CONC. EDGE
CHECK W/ T.S.I. ON HATCH COVER DETAIL FOR 3-H. FIRE RATING

ATTACHMENT 2

Review of Fire Protected Hatches

This attachment evaluates the fire resistance of hatches which are being protected against fire as a result of our Appendix R commitments. This attachment addresses the fire protection measures applied to the six Bilco type hatches and an additional three field fabricated hatches which are currently installed at the D. C. Cook Nuclear Plant.

The unprotected hatches do not have a fire rating. We do not presently know of any manufacturer who can provide us with an Underwriters' Laboratory listed or Factory Mutual approved fire rated hatch. As a result, a fire insulating/subliming material manufactured by Thermal Science, Inc. (TSI), THERMO-LAG 330-1, was chosen to be applied to the underside of the hatches to increase their fire resistance. In order to show an equivalency to the required fire resistance ratings of 1 1/2 and 3 hours, heat transfer calculations were performed by our Analytical & R&D Section of the Mechanical Engineering Division.

Data

The hatch is made up of two basic components, the cover and frame. The cover for eight of the hatches consists of a 1/4 inch steel plate which is either hinged to or rests on the support frame. The frame for eight of the hatches is made from continuous steel angles anchored to the concrete floor using steel straps. The cover for the ninth hatch is made of 1" steel grating which rests on a recessed concrete ledge.

A computer model of the hatch plate cover was used to perform the heat transfer calculations. The heat transfer calculations are based on the fire exposure specified by the ASTM E-119 Test Method, an initial ambient temperature of 68° on the fire side of the hatch, and a constant ambient temperature of 68°F is assumed to be maintained on the unexposed side (non fire side) of the hatch. The heat transfer path during the fire will be from the fire to the underside of the hatch assembly, through the TSI material and the hatch cover plate by conduction, and then to the ambient air by free convection and radiation. The model was also based on the following parameters.

1. Fire exposure is to the underneath side of the hatch.

2. No heat is transferred between the plate cover and angle frame.

3. Heat transfer through the fire barrier material is uniform across the plate cover.

4. When the affect of unprotected surfaces must be accounted for, the total unprotected surface area modeled was 16 square inches.

5. TSI material is applied directly to the bottom hatch surface.

Temperatures were extrapolated from the above analytical model to address actual field installation.

Results of Calculations

A. Bilco Hatches

In the case of a bare steel hatch cover, the average unexposed steel surface temperature was calculated to be approximately 1383°F after a 1-1/2 hour fire exposure and 1517°F after a 3 hour fire exposure.

The hatch modification covers the underside of each hatch cover with a 1-inch layer of THERMO-LAG 330-1 Subliming Material and approximately a 1-inch layer of ceramic blanket material within the area created by the stiffener frame. The design also incorporates a barrier utilizing 1-inch of TSI material to protect the angle frame, torsion bars, automatic hold-open arm, and hinges from direct exposure to the fire.

The protected hatches in the 3-hour fire areas are protected as stated above. The only hatches of this type are located in the control rooms, which are constantly occupied. There are no unprotected surface areas (hotspots) to be accounted for in the analysis of these hatches. When all areas of the hatch plate are completely covered with the THERMO-LAG subliming material, as in these cases, the average unexposed surface temperature of 401°F (333 degrees above ambient) would result at the end of a three hour fire exposure. No credit is taken for the additional layer of ceramic blanket in the analysis. This temperature would apply to the hatch plates and shielded components in the 3-hour fire area.

The hatches located in the 1 1/2-hour fire areas are also protected as stated above with the exception of an unprotected surface area (no TSI material) where the balanced magnetic switch is located on the underside of the hatch. This unprotected surface will cause the formation of a hotspot on the hatch cover. On the unexposed surface, the highest temperature calculated after 1 1/2 hours was 1350°F directly opposite the unprotected area. When averaged with the surrounding metal, an average temperature of 1000°F is estimated for this area after approximately 1 hour and 36 minutes. When this area is averaged with the remaining portion of the hatch plate, the resulting average unexposed

surface temperature is 318°F (or 250 degrees above ambient) after approximately 1 hour and 25 minutes and 333°F (or 265 degrees above ambient) after 1 hour and 30 minutes.

A criteria of the building construction fire test methods taken from NFPA Standard 251, requires that the transmission of heat through the specimen during the classification period cannot raise the average temperature on the unexposed surface more than 250°F above its initial temperature. Therefore, the amount of time needed to reach the 318°F average unexposed surface temperature demonstrates that on the above heat transmission criteria, the 1-inch of fire resistive TSI material can reasonably provide fire resistance of 1 1/2 hours even with the inclusion of the unprotected area. The 3-hour hatch plates attain a temperature rise of approximately 333°F which is 83°F above the specified 250°F temperature rise. This temperature is considerably less than the failure temperature for structural steel members, therefore, it is judged that the hatch will remain intact. In each case, these temperatures would be further reduced by the installed ceramic blanket material.

B. FIELD FABRICATED HATCHES

There are three field fabricated hatches which require a fire rating. Two of the hatches are constructed of steel plate similar to that of the Bilco hatches and are located in the 1 1/2 hour fire areas. The remaining hatch is constructed of steel grating which has no effective fire rating. This hatch is located in a 3 hour fire area.

As previously described, a bare steel hatch cover has an average unexposed steel surface temperature of approximately 1383°F after a 1 1/2 hour fire exposure. The 1 1/2 hour hatch modifications cover the underside of each steel plate with a 1/2-inch layer of THERMO-LAG 330-1 Subliming Material, approximately a 3/4-inch layer of ceramic blanket material and another 1/2-inch layer of the THERMO-LAG Subliming Material. There are no unprotected surface areas (hotspots) to be accounted for in the analysis of these hatches. The design also incorporates a barrier utilizing 1-inch of TSI material to protect the angle frame. When all areas of the hatch plate are completely covered with the subliming material, as in this case, an average unexposed surface temperature of 172°F (104 degrees above ambient) would result at the end of a 1 1/2 hour fire exposure with no credit taken for the additional layer of ceramic blanket. This temperature would apply to the hatch plates and shielded angle frame in a 1 1/2 hour fire area.

The 3-hour hatch design covers the underside of the steel grating with a 1-inch layer of TSI material. There are no unprotected surface areas (hotspots) to be addressed. There is no angle frame provided, since the hatch sits in a

recessed concrete ledge. Although our Analytical and R&D Section has not performed a calculation for this design, TSI has reviewed this design and has determined that it meets the criteria of their 3-hour firewall test program.

CONCLUSION

The above description of the various calculations demonstrate certain equivalencies of the protected hatches to the required fire resistances of 1 1/2 and 3 hours. These are summarized below:

For those hatches which require a 1 1/2 hour rating, the hatch cover plate model shows that 1-inch of the fire resistive material results in an averaged unexposed surface temperature of 250°F above ambient after 1 hour and 25 minutes which is only 5 minutes short of the required classification period. While hatches which require a 3 hour rating will not achieve a 3 hour fire resistance classification, on a heat transmission basis, they are judged to be able to retain their structural integrity through a three hour fire exposure.

These conclusions are based on the application of 1-inch of TSI material with no credit taken for the ceramic blanket and its thermal insulation properties.

ADDITIONAL QUALITATIVE FIRE PROTECTION FEATURES IN THE HATCH AREAS

The Fire Hazards Analysis shows that each of the areas above and below the hatches have fire loadings which have an equivalent fire severity approximately equivalent to 1 hour under the ASTM E-119 Time-Temperature Curve. This fire severity of 1 hour demonstrates the conservative nature of our calculations and design, since it is less than the 1 1/2 and 3 hour fire resistance that we were trying to achieve for the hatches.

Additionally, with the completion of the Appendix R modifications, all the areas (above and below) where the subject hatches are located will contain either a fire detection or suppression system. These fire detection and suppression systems are in addition to the normal compliment of manual hose stations and portable fire extinguishers.

In addition, the control room areas, which are above two of the hatches, are constantly occupied.