SILICONE RUBBER FIRE BARRIERS

1. Background

In preparation for inspection closeout of silicone rubber fire barrier installations, the RIII inspector performed a detailed review of: Bechtel Specification No. 7749-M-255; Factory Mutual Research (FMR) test report Serial No. 24963 (4510); and Brand Industrial Services, Inc. (BISCO) test report project No. 4835-02-1.

2. Requirements

Specification 7749-M-255, above, requires that materials used as fire stops must withstand a 3 hour fire test and hose stream test in accordance with ASTM-E-119-73. The FMR test was a fire stop resistance test and the BISCO test was a hose stream test.

3. Conclusions

Neither the Fire Stop Resistance Test nor Hose Stream Test appeared to be "truly representative of the construction for which classification (was) desired" (quoted from ASTM E-119-73) or, since these were "prototype tests", "under the most adverse design conditions" (quoted from 10 CFR 50, Appendix B, Criterion III). See part 5 details.

4. Extenuating Circumstances (as presented by Bechtel to justify installation at Davis-Besse)

a. March 26, 1975 - Factory Mutual Research fire test was performed.

b. July 22, 1975 - NRR requests information from TECo including design criteria and procedures for fire stops and seals. Must reply by November 3, 1975. (Exhibit A)

c. August 5, 1975 - Factory Mutual Research publishes "Fire Test on Silicone Rubber Penetration Seals in Masonry Wall" for BISCO. (Exhibit B)

d. September 19, 1975 - NEL-PIA advises BISCO that silicone foam, cable and pipe penetration seals are acceptable to NEL-PIA. States "a delay to await fire test results would be impractical". (Exhibit C)

e. September 30, 1975 - NEL-PIA advises TECo that BISCO, Chemtrol Corporation, and Insulation Consultants and Management Service, Inc. are acceptable to NEL-PIA. States "a delay to await fire test results may be impractical". (Exhibit D)

f. Silicone foam selected by TECo for fire stops. Exact date not known by RIII, however, TECo's response to NRR (g-below) dated November 3, 1975, part 2, stated in part that "silicone foam has only recently been selected". Significance - Fire tests already performed by FMR. Silicone foam accepted by NEL-PIA, Therefore Bechtel's contention is that the ASTM tests were "material" tests only and not meant to be representative of installations at Davis-Besse.

g. November 3, 1975 - TECo answers NRR's concerns from NRR's letter of July 22, 1975 (b. above). Part 2, item 2(b) of the November 3, 1975 letter states "each type of fire stop has a tested fire rating equal to or greater than that of the penetrated fire rated floor or wall". 2(c) states in part that "fire stops are installed only at wall and floor penetrations". Paragraph 2(d) states in part that "the final silicone forms and dams have been tested to ASTM-E-119 by Factory Mutual Research". 2(d) fails to stipulate that the test was performed in "Masonry Wall" only and that no floor tests were conducted and at that time no hose stream tests had been conducted.

h. July 9, 1976 - BISCO informs Bechtel that NEL-PIA's approval of penetration seals included both floor and wall assemblies and approval not contingent upon further testing such as a hose stream test. (Exhibit E)

i. December 14, 1976 - BISCO performs hose stream test. (Exhibit G) The hose stream test consisted of a one hour flame exposure followed by impinging a water stream on the test specimen.

5. Details

a. Bechtel specification No. 7749-M-255 states in paragraph 7.4.3, 7.4.4, and 8.1 that "Fire Resistance: To withstand minimum 3 hour large scale fire exposure when tested in accordance with ASTM-E-119 for nonbearing walls. Hose stream test required, per section 8.0 of ASTM E-119".

b. Paragraph 7.1.4 of the above specification states "All ducts, pipes, trays and conduits passing through fire walls as indicated on the drawings or passing through floor openings shall be provided with fire stops".

c. Paragraph 7.4.2 of the above specification states "A fire stop is defined as a fire retardant barrier that, when tested in accordance with ASTM E-119-73 wall test method will demonstrate a result equivalent to the requirements of a material having a 3 hour rating".

d. Paragraph 7.4.3 states in part that "the low density flexible silicone foam . . . . shall be used as fire stops and air seals for wall and floor openings."

e. Factory Mutual Research "Fire Penetration Seals in Masonry Wall" performed March 26, 1975 and documented in test report dated August 5, 1975. (Exhibit B)

f. BISCO Hose Stream Test performed December 14, 1976. (Exhibit G)

g. American Society of Testing and Materials (ASTM) E-119-73, Section 6.1 states: "Test Specimen - the test speciman shall be truly representative of the construction for which classification is desired, as to materials, workmanship, and details such as dimensions of parts, and shall be built under conditions representative of those obtaining as practically applied in building construction and operation".

h. The following apparent discrepancies were noted:

Fire Test

(1) A floor test (vertical) was not specified in specification 7749-M-225 (ASTM E-119-73, paragraph 23), nor was a vertical fire endurance performed.

(2) None of the test penetrations were formed, i.e. foamed in place, (Exhibit B, BISCO Spec. 207), as is done in the field at Davis-Besse. Even though a wall fire test was performed the penetrations were filled vertically. (Exhibit B, page 3, paragraph 1 and illustrations 4, 5, 6, 7 and 8; and page 4 - No. 6)

(3) The cable configurations in tray were not representative of those at Davis-Besse, i.e. % filled, cable type, diameter, etc. (Exhibit B, page 3 - items 1 and 10).

(4) The tray installation was not representative of Davis-Besse, i.e. tray in penetrations No. 1 and No. 10 was surrounded by silicone foam in the following manner: No. 1 - had 3"

on top and bottom - 6" on sides' No. 10 - had 6" on top and bottom - 18" on sides and 12" deep. (Exhibit B, illustration No. 1, page No. 10) Actual D-B installations (depth unknown) are shown in Exhibit H - sheet 23 wall openings;-tray;sheet 24 floor openings;-tray;sheet 25 wall openings conduit; sheet 17 floor openings conduit. None of the above installations are similar to those tested during the FMR tests.

(5) Both cable tray penetrations, which were tested by FMR i.e. No. 1 and No. 10, were "faced" with 1" thick BISCO part No. MFB-1600 damming material - service temperature of 1200°F. The material was left in place during the fire test. This type of damming material is not known to be used at Davis-Besse. The material acted as a fire barrier and protected the silicone foam material for approximately 60 minutes during the fire endurance test. (Exhibit B, page 3, No. 1 and page 4, No. 10. Test results page 7)

(6) Flexible ceramic fibers, BISCO part No. CFR 2300 fire barrier not apparently tested by FMR i.e. not listed in any portion of Exhibit B, page 3, 4, or 5, even though the material is listed in Exhibit B page 2 as being tested. This material is in use at Davis-Besse and is part of specification 7749-M-225 paragraph 7.2.2.d.

Hose Stream Test

As in item (4), above, the tray installation was not representative of Davis-Besse. (Exhibit G, drawing No. 4835-02-1 and Exhibit H, sheets 23 and 24.)