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Project Title/Work Order		EDT No. 600673
Fire Barrier Evaluation of the Wall Between Spent Nuclear Fuel Basins and Reactor Areas, 105KE and 105KW		ECN No. N/A

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16. KEY

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Document Title: Fire Barrier Evaluation of the Wall Between Spent Nuclear Fuel Storage Basins and Reactor Areas, 105KE AND 105KW

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This document was reviewed following the procedures described in WHC-CM-3-4 and is:

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SUPPORTING DOCUMENT

1. Total Pages 34

2. Title	3. Number	4. Rev No.
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6. Author

Name: B. H. Johnson

B.H. Johnson
Signature

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7. Abstract

This fire barrier evaluation provides a comprehensive assessment of the risks from fire and fire related perils for the fire barriers between spent nuclear fuel storage basins and reactor areas inside buildings 105KE and 105KW.

The information contained in this document was obtained by walk-down of each barrier by a qualified Fire Protection Engineer. The approach taken was to perform a complete walk-down of the barriers, identify the fire risks present in the areas adjacent to the fire barriers, analyze the design documentation and develop an engineering judgement of the adequacy of the barriers and modifications necessary to bring the barriers up to a 2-hour fire rating.

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WHC-SD-W405-PD-001
Rev. 0

FIRE BARRIER EVALUATION

OF THE WALL BETWEEN SPENT NUCLEAR FUEL STORAGE BASINS AND REACTOR AREAS, 105KE AND 105KW

PROJECT W-405, K BASINS ESSENTIAL SYSTEMS RECOVERY

FIRE PROTECTION UPGRADES TASK

Prepared for:

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October 14, 1994

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ABBREVIATIONS, ACRONYMS, AND INITIALISMS

ANI	American Nuclear Insurers
dia.	diameter
FM	Factory Mutual
ft	feet or foot
HFD	Hanford Fire Department
hr	hour or hours
in.	inch or inches
MCC	Motor Control Center
MPFL	Maximum Possible Fire Loss
NFPA	National Fire Protection Association
SFPE	Society of Fire Protection Engineers
UBC	Uniform Building Code
WHC	Westinghouse Hanford Company

1.0 ABSTRACT

This fire barrier evaluation is intended to provide a comprehensive assessment of the risks from fire and fire related perils for the fire barriers between spent nuclear fuel storage basins and reactor areas, 105KE and 105KW, at the Department of Energy (DOE) Hanford Site. The analysis has been prepared in accordance with the Statement of Work submitted to Columbia Energy & Environmental Services, Inc. under Purchase Order M-293887, Task Number 94-01. The analysis of these barriers and the development of this report was prepared by Jack Poole, P.E. of Poole Fire Protection Engineering, Inc., Spring Hill, Kansas (see Appendix A for resume and copy of P.E. Certificate).

The information contained in this report was obtained from a walk-down of each barrier and the references listed in Section 9.0 of this report. The approach taken was to perform a complete walk-down of the barriers, identify the fire risks present in the areas adjacent the fire barriers, analyze the design documentation and develop an engineering judgement of the adequacy of the barriers.

2.0 EXECUTIVE SUMMARY

This evaluation is intended to provide a comprehensive assessment of the risks from fire and fire related perils for the fire barriers between spent nuclear fuel storage basins and reactor areas, 105KE and 105KW.

As a result of this fire barrier evaluation the present walls and the components thereof are not a true listed fire rated assembly. However, due to the construction of these barriers and the components thereof, these barriers will provide an equivalent level of protection provided the recommendations in Section 8.0 of this report are completed. These recommended upgrades are based upon sound engineering practice by a Registered Fire Protection Engineer.

The construction of the barriers are substantial enough to provide the required 2-hr fire resistance rating. The primary concern is the numerous penetrations in the barrier. There are many penetrations that are adequate and no additional work is required. These penetrations are the ones that were poured-in-place at the time of construction.

The penetrations that are of concern are some of the doors, the HVAC ducts, and the unsealed piping and conduit penetrations. There are several metal doors that should be replaced because the existing doors have either a non-approved window or louver that will not limit the spread of fire to one side of the barrier. All unsealed piping and conduit penetrations should be firestopped with an approved firestopping material. The existing non-active ducts that pass through the barrier should be disconnected at the barrier and the opening sealed with an approved firestopping method.

3.0 OBJECTIVE

3.1 PURPOSE AND NEED

This evaluation shall access the barriers between the D&D (inactive) areas and the active areas of Buildings 105KE and 105KW. The assessment shall evaluate the construction, all penetrations and the overall adequacy of the barrier to serve as a fire rated separation.

As a result of the assessment, the necessary actions for compliance of a fire barrier of the required rating shall be identified. These actions will be implemented to upgrade the barrier to serve as a fire rated barrier or the equivalency thereof.

3.2 BACKGROUND

The 100 K Area facilities are located near the Columbia River at the 100KE and 100KW reactor sites on the northern edge of the Hanford Site, north of Richland, Washington.

Buildings 105KE and 105KW are the main reactor buildings. All levels of these buildings are deactivated except for the ground level (elevation 0-ft, 0-in.) which is approximately 30,000 ft^2 in area. The fuel storage basin and handling areas, some support office spaces, the Electrical Equipment/Motor Control Center (MCC) rooms and the compressor rooms remain active. The active areas consist of the approximate areas between column lines 1 through 16 and column lines A through G which is the Storage Basin area, and the area from column lines 1 through 5 and column lines G through approximately L.7 which is the office/support areas. The exterior walls are corrugated asbestos-cement panels on a steel frame or reinforced concrete. The roof consists of corrugated asbestos-cement panels (as roof decking) covered with one layer of approximately 1-in. to 2-in. of lightweight insulating concrete, one layer of fiberboard insulation and layers of asphalt and paper typical of built-up roofing systems. At Building 105KW a new standing seam metal roof structure has been installed over the existing roof for the fuel storage basin area. Most of the active portions of the office areas, located north of column line L and east of column line 5 at the 0-ft, 0-in. level, are provided with automatic sprinkler protection.

In March 1994, an engineering study was completed which provided preferred alternatives for resolution of non-compliant fire protection conditions at the 100K area in support of Project N037, 100K Area Fire Protection Upgrades. The study identified the need to evaluate and upgrade the 3- to 5-ft-thick concrete barrier between the active and inactive areas of the 105KE and 105KW facilities to act as a 3-hr fire rated separation between the two areas.

3.3 PROJECT SCOPE

This report is intended to document the current condition of the barriers between the D&D areas and the active areas of Building 105KE and 105KW and identify the necessary actions to upgrade the barrier to serve as a fire rated barrier or the equivalency thereof. The barriers utilized to separate these two areas are not necessarily the actual barrier separating the two areas, but were utilized due to their physical construction and greater potential for serving as a fire resistive barrier.

The actual barriers that were evaluated and are proposed to be used as the separation barriers for the fire area separations are as follows:

Elevation below 0-ft, 0-in.:

- Reinforced concrete barrier from column lines P to north of M along column line 1.5. This barrier is 2-ft, 0-in. thick.
- Reinforced concrete barrier from column lines 1.5 through 5 north of column line M. This barrier is 2-ft, 0-in. thick.
- Reinforced concrete barrier from column lines north of M through G along column line 5. This barrier from north of column line M to H is 3-ft, 0-in. thick, and from column lines G to H is 5-ft, 0-in.
- Reinforced concrete barrier from column lines 5 through 16 along column line G. The portion of the barrier between column lines 5 and 12.2 at 5-ft, 0-in. thick per the drawings. The portion of the barrier between column lines 12.2 and 15.5 is 3-ft, 0-in. thick.

Elevation 0-ft, 0-in. and above:

- Reinforced concrete barrier from column lines 1 through 5 north of column line M. This barrier is 1-ft, 0-in. thick from column line 1 to 1.5 and 2-ft, 0-in. thick from column lines 1.5 to 5. This barrier terminates at the roof of the office area.
- Reinforced concrete barrier from column lines north of column line M through G along column line 5. This barrier from north of column line M to H is 3-ft, 0-in. thick, and from column lines G to H is 5-ft, 0-in. This barrier terminates at the roof of the office area.
- Reinforced concrete barrier from column lines 5 through 16 along column line G. The portion of the barrier between column lines 5 and 12.2 measures 5-ft, 6-in. thick (drawings indicate 5-ft, 0-in.). The portion of the barrier between column lines 12.2 and 15.5 is 3-ft, 0-in. thick. This barriers extends past the roof level of 51-ft, 6-in and stops at the roof of the main elevator shaft at 66-ft, 0-in.

All accessible areas of these barriers were walked-down to visually access the current condition of the barrier and identify all penetrations. The available as-built drawings and design documentation were reviewed to determine how the barrier was constructed and to verify poured-in-place penetrations.

Applicable DOE Orders, nationally recognized codes and standards and acceptable industry practice were evaluated to determine and document the required fire resistive rating of the barrier.

As a result of the walk-down, design documentation review and the code analysis, the necessary actions for compliance were identified. These actions should be implemented to upgrade the barrier to serve as a fire rated barrier or the equivalency thereof.

4.0 CONCLUSIONS

As a result of the walk-downs and the evaluation of the barriers, they and the components thereof are not a fire rated assembly by definition. Since the construction of these barriers and the components are similar to that of a barrier having a fire resistance rating of at least 2-hr (UCBC Figures 1.1.2 and 1.1.4, UL Fire Resistive Directory Design No.'s U900 Series, and FM Data Sheet 1-21, Table 2), these barriers are expected to qualify for a 2-hr fire resistance rating provided the following upgrades are performed (see Section 8.0 for a detailed list of actions).

- The unsealed miscellaneous piping and conduit penetrations shall be firestopped with an approved firestopping material having a fire resistance rating of 2-hr.

- The personnel doors that have windows or louvers shall be replaced with a UL Listed Fire Door having a fire resistance rating of 1½-hr. A 1½-hr door is acceptable in a 2-hr barrier per the NFPA codes. The reason being is that the fire exposure to a door is less since combustibles are not stored against the door. If the door is not used and combustibles are stored against the door, the door should be removed and the penetration appropriately sealed.

- The HVAC ducts that pass through the barrier should be disconnected at the barrier and the opening sealed with an approved firestopping material with a fire resistance rating of 2-hr. Per conversations with facility personnel these ducts are no longer operational. Therefore, it is more cost effective to disconnect one side of the duct and completely seal the penetration.

The recommended upgrades are based upon sound engineering practice by a Registered Fire Protection Engineer.

5.0 RESULT OF THE WALK-DOWNS

On June 24, 1994 Cheryl Myott, Stan Wallace, Jack Poole and a facility operator walked-down all accessible areas of all levels of the barrier between the reactor and the basin in Building 105KE. All areas on both sides of this barrier are contaminated areas and required protective clothing. This walk-down consisted of all areas on the fuel storage basin side except the floor areas at elevation 38-ft, 0-in. and the roof level. The floor areas at elevation 38-ft, 0-in. and the roof level were not accessed because the access doors in the stairway were locked and blocked closed. The area between the barrier and the back-side of the reactor, where the elevator is located, was also accessed.

As a result of the walk-down of the areas noted above the following items were noted:

- The portion of the barrier between column lines 5 and 12.2 are 5-ft, 6-in. thick per field measuring, drawings indicate 5-ft, 0-in.
- The portion of the barrier between column lines 12.2 and 15.5 is 3-ft, 0-in. thick.
- The wall only extends slightly (approximately 2-ft) below the water level of the basin. There is a "banana wall" at the discharge pick-up chute areas. This was designed so the rods would fall into the water on the reactor side, slide down the banana wall and into the storage basin.
- Door 150 is a solid metal door and is 10-ft, 9-in. by 9-ft and is 2-in. thick.
- Doors 152 , 153, 206, 207, 306, 307, 402, and 403 are metal doors and are 4-ft, 2-in. by 7-ft, 8-in. and 14-in. thick.
- Door 159 is a pair of metal doors into Corridor no. 10 that are not Listed fire doors having a total opening width of 7-ft by 6-ft.
- Doors 160, 210, and 310 into the electrical equipment room are metal doors and are 3-ft, 0-in. by 7-ft, 0-in. and is 1¾-in. thick.
- There are a total of 112 6-in.-dia. access ports through the 5-ft, 6-in. thick barrier. These ports are sealed with two 14-in. by 5⅞-in.-dia. plugs that are constructed of ⅛-in. rolled metal plate filled with concrete . Plastic is covering the majority of these penetrations on the reactor side of the barrier. Some of the plugs have been removed from the access ports and these penetrations are being used for instrumentation tubing, conduit or piping. However, the space around the instrumentation tubing, conduit or piping has been sealed with what appears to be lead wool or an equivalent type of material.
- There are numerous conduit and miscellaneous pipe penetrations through the barrier. These are poured-in-place penetrations and are tightly sealed.
- There is one new penetration that is not sealed. It is located above Door 160 and is a 6-in.-dia. penetration with one 4-in.-dia. and one 1-in.-dia. conduit passing through it.
- There is a viewing window located at floor elevations 15-ft, 0-in. and 38-ft, 0-in.
- There are four (4) ventilation ducts through the barrier at floor elevation 38-ft, 0-in. per the drawings. The drawings indicate that each duct has two 90° elbows within the barrier which will provide a greater level of fire resistance.

On July 12, 1994 Ben Johnson, Jack Poole and a facility operator walked-down all accessible areas of the barrier separating the office areas from the reactor areas in Building 105KE. All areas on both sides of this barrier are clean and did not required protective clothing. This walk-down

consisted of all office areas at elevation 0-ft, 0-in. and in the basement area below the office area, floor elevation -12-ft, 0-in.

As a result of the walk-down of the barrier at the 0-ft, 0-in. elevation the following items were noted:

- The barrier from column lines 1 through 1.5 north of column line M is 1-ft, 0-in. thick and the barrier from column line 1.5 to 5 is 2-ft, 0-in. thick.
- The barrier from north of column line M through H along column line 5 is 3-ft, 0-in. thick, and from column lines G to H is 5-ft, 0-in.
- The barrier from column lines 5 through 12.2 measures 5-ft, 6-in. thick (drawings indicate 5-ft, 0-in.). The portion of the barrier between column lines 12.2 and 15.5 is 3-ft, 0-in. thick.
- There are numerous conduit and miscellaneous pipe penetrations through the barriers that are poured-in-place.
- A 1½-in.-dia. open conduit penetration, contains miscellaneous telephone lines located at column line L-3.
- Door 115, located at Corridor no. 3, is a metal door and is 10 ft by 9 ft and is 1¾-in. thick with a small plexiglass window and there are several penetrations in the door frame.
- Door 104 into the control room is a 3-ft, 0-in. by 6-ft, 8-in. by 1¾-in. thick metal door with a plexiglass window.
- Door 105 into the counting room is 3-ft, 0-in. by 6-ft, 8-in. by 1¾-in. thick metal door.
- There are three, unsealed 2½-in.-dia. pipe penetrations to the east of the control room Door 105.
- There is a duct in the area of the control room Door 105 that is not provided with a fire damper as required.
- There is an opening at column lines H-5 (Door 131), into Corridor no. 6 that is not provided with a fire door at the barrier.

As a result of the walk-down of the barrier below elevation 0-ft, 0-in. the following items were noted:

- The barrier from column lines P through M.5 along column 1.5, from column line 1.5 through 5 north of column line M and from column lines north of M through H along column line 5 are 3-ft, 0-in. thick and the barrier from column lines G through H along column line 5 is 5-ft, 0-in. thick per the drawings.
- There are numerous conduit and miscellaneous pipe penetrations through the barriers that are poured-in-place.
- A 10-in. by 7-ft, 6-in., penetration for numerous pipes and conduit located at column lines 1.5 and M is not firestopped.
- A 10-in.-dia. pipe penetration for a sanitary sewer line located north of column line M and 2 is not sealed.
- A 6-ft, by 7-ft, 8-in. opening in the barrier is not provided with a fire door at approximately column L-5 which is identified as Door 28 on the drawings.
- There is a 1-ft,by 5-ft, 8-in., opening for piping and conduits above the opening at column L-5 (Door 28).

- The entrance door (Door 27) into the basement area at column line J.e-5 is 2-ft, 6-in. by 7-ft, 0-in. by 1¾-in. is not a rated fire door, but is expected to provide an equivalent fire resistance rating.
- There are two ducts that penetrate the barrier along column 5 that are not protected with fire dampers.
- There are four 3-in.-dia. unsealed pipe penetrations near the entrance door (Door 27) to the basement area.
- Door 12 into the Tool Dolly/Machine Room is 3-ft, 0-in. by 7-ft, 0-in. by 1¾-in. and has a louver. The door is a non-rated door.

On June 27, 1994 Stan Wallace, Jack Poole and a facility operator walked-down all accessible areas of all levels of the barrier between the reactor and the basin in Building 105KW. All areas at floor elevation 0-ft, 0-in. of the barrier is clean and did not required protective clothing, with the exception of the back-face of the reactor. The support areas on levels 15-ft, 0-in., 28-ft, 0-in. and 38-ft, 0-in. was a radiation area and required protective clothing.

As a result of the walk-down of the areas noted above the following items were noted:

- The portion of the barrier between column lines 5 and 12.2 are 5-ft, 6-in. thick per field measuring, drawings indicate 5-ft, 0-in..
- The portion of the barrier between column lines 12.2 and 15.5 is 3-ft, 0-in. thick.
- The wall only extends slightly (approximately 2-ft) below the water level of the basin. There is a "banana wall" at the discharge pick-up chute areas. This was designed so the rods would fall into the water on the reactor side, slide down the banana wall and into the storage basin.
- Door 150 is a solid metal door and is 10-ft, 9-in. by 9-ft and is 2-in. thick.
- Doors 152 , 153, 206, 207, 306, 307, 402, and 403 are metal doors and are 4-ft, 2-in. by 7-ft, 8-in. and 14-in. thick.
- Door 159 is a pair of metal doors into Corridor no. 10 that are not Listed fire doors having a total opening width of 7-ft by 6-ft.
- Doors 160, 210, and 310 into the electrical equipment room are metal doors and are 3-ft, 0-in. by 7-ft, 0-in. and is 1¾-in. thick.
- There are a total of 112 6-in.-dia. access ports through the 5-ft, 6-in. thick barrier.
- These ports are sealed with two 14-in. by 5⅞-in.-dia. plugs that are constructed of ⅛-in. rolled metal plate filled with concrete. Plastic is covering the majority of these penetrations on the reactor side of the barrier. Some of the plugs have been removed from the access ports and these penetrations are being used for instrumentation tubing, conduit or piping. However, the space around the instrumentation tubing, conduit or piping has been sealed with what appears to be lead wool or an equivalent type of material.
- There are numerous conduit and miscellaneous pipe penetrations through the barrier. These are poured-in-place penetrations and are tightly sealed.
- There is one new penetration that is not sealed. It is located above Door 160 and is a 6-in.-dia. penetration with one 4-in.-dia. and one 1-in.-dia. conduit passing through it.
- There is a viewing window located at floor elevations 15-ft, 0-in. and 38-ft, 0-in.
- There are four (4) ventilation ducts through the barrier at floor elevation 38-ft, 0-in. per the drawings. The drawings indicate that each duct has two 90° elbows within the barrier which will provide a greater level of fire resistance.

On July 12, 1994 Ben Johnson, Jack Poole and a facility operator walked-down all accessible areas of the barrier separating the office areas from the reactor areas in Building 105KW. All areas on both sides of this barrier are clean and did not required protective clothing. This walk-down consisted of all office areas at elevation 0-ft, 0-in. and in the basement area below the office area.

As a result of the walk-down of the barrier at the 0-ft, 0-in. elevation the following items were noted:

- The barrier from column lines 1 through 1.5 north of column line M is 1-ft, 0-in. thick and the barrier from column line 1.5 to 5 is 2-ft, 0-in. thick.
- The barrier from north of column line M through H along column line 5 is 3-ft, 0-in. thick, and from column lines G to H is 5-ft, 0-in.
- The barrier from column lines 5 through 12.2 measures 5-ft, 6-in. thick (drawings indicate 5-ft, 0-in.). The portion of the barrier between column lines 12.2 and 15.5 is 3-ft, 0-in. thick.
- There are numerous conduit and miscellaneous pipe penetrations through the barriers that are poured-in-place.
- A 1½-in.-dia. open conduit penetration, contains miscellaneous telephone lines located at column line L-3.
- Door 115, located at Corridor no. 3, is a metal door and is 10 ft by 9 ft and is 1¾-in. thick with a small plexiglass window and there are several penetrations in the door frame.
- Door 104 into the control room is a 3-ft, 0-in. by 6-ft, 8-in. by 1¾-in. thick metal door with a plexiglass window.
- Door 105 into the counting room is a 3-ft, 0-in. by 6-ft, 8-in. by 1¾-in. thick metal door.
- There are three, unsealed 2½-in.-dia. pipe penetrations to the east of the control room Door 105.
- There is a duct in the area of the control room Door 105 that is not provided with a fire damper as required.
- There is a 1-in.-dia. sprinkler pipe that penetrates the barrier adjacent Door 105 that is not sealed.
- There is an opening at column lines H-5 (Door 131), into Corridor no. 6 that is not provided with a fire door at the barrier.

As a result of the walk-down of the barrier below elevation 0-ft, 0-in. the following items were noted:

- The barrier from column lines P through M.5 along column 1.5, from column line 1.5 through 5 north of column line M and from column lines north of M through H along column line 5 are 3-ft, 0-in. thick and the barrier from column lines G through H along column line 5 is 5-ft, 0-in. thick per the drawings.
- There are numerous conduit and miscellaneous pipe penetrations through the barriers that are poured-in-place.
- A 10-in. by 7-ft, 6-in., penetration for numerous pipes and conduit located at column lines 1.5 and M is not firestopped.
- A 10-in.-dia. pipe penetration for a sanitary sewer line located north of column line M and 2 is not sealed.

- A 6-ft, by 7-ft, 8-in. opening in the barrier is not provided with a fire door at approximately column L-5 which is identified as Door 28 on the drawings.
- There is a 1-ft, by 5-ft, 8-in., opening for piping and conduits above the opening at column L-5 (Door 28).
- The entrance door (Door 27) into the basement area at column line J.e-5 is 2-ft, 6-in. by 7-ft, 0-in. by 1¾-in. with a window and is not a rated fire door.
- There are two ducts that penetrate the barrier along column 5 that are not protected with fire dampers.
- There are four 3-in.-dia. unsealed pipe penetrations near the entrance door (Door 27) to the basement area.
- Door 12 into the Tool Dolly/Machine Room is 3-ft, 0-in. by 7-ft, 0-in. by 1¾-in. and has a louver. The door is a non-rated door.

In completing these walk-downs it was noted that the combustible loading in all areas was light. The office/support areas had a higher combustible loading than all other areas that were surveyed. The combustible loading throughout the office/support areas is estimated to be less that 10 pounds per square foot. The combustible loading in the storage basin area was limited to approximately eight bags of contaminated protective clothing that was awaiting to be picked up for decontamination. The reactor support areas (sample room, gamma monitoring room and the ready room) had a very low combustible loading. In fact, the only combustibles in the space were a few sets of protective clothing and some tools, i.e., electrical cords on drills, air hoses, etc. The point being that the total combustible loading throughout all areas are low and do not present a specific concern for this type of facility.

6.0 CONDITION AND ADEQUACY OF THE BARRIERS

6.1 CONDITION OF THE BARRIERS

Based upon the walk-down of the barriers as identified, the barriers are in good condition with the exception of the unsealed penetrations, lack of fire dampers, and the non-rated doors. The majority of the barriers are constructed of 2 to 5-ft, of reinforced concrete. The primary purpose of these barriers are for radiation shielding and were not originally designed to be fire barriers.

As noted, there are many penetrations in these barriers; however, they were poured in-place at the time of original construction. The penetrations that are poured in-place and are for piping or rigid conduit that do not terminate at the face of the barriers has been considered as an adequately sealed penetration.

There are several relatively new penetrations that are noted in Section 5.0 that are not sealed at all or do not have sufficient firestopping to meet the integrity of a rated fire barrier. It should be noted that there may be additional unsealed penetrations that were not identified in Section 5.0 due to the lighting conditions of some areas during the walk-downs. Any additional unsealed or inadequately sealed penetrations noted during the upgrade process should also upgraded consistent with the other penetrations.

These barriers were not originally constructed as fire barriers; however, due to the physical construction and with the modifications as identified in Section 8.0 of this report, these barriers will be equivalent to a fire resistive barrier. New reinforced concrete barriers having a thickness of 8-in. will almost always have a fire resistance rating of at least 2-hr. Therefore, it is expected that the existing barriers having a thickness of 2- to 5-ft-thick will have an equivalent rating of 2-hr.

6.2 ADEQUACY OF THE BARRIERS

The vault type doors that serve as entrance doors to the back-side of the reactor are not labeled as fire doors. These vault type doors are Doors 152, 153, 206, 207, 306, 307, 402, and 403 at floor elevation 0-ft, 0-in., 15-ft, 0-in., 28-ft, 0-in. and 38-ft, 0-in. Due to their massive construction (14-in.-thick) it would be expected that these door could withstand a fire in excess of 2-hr.

The apparent standard metal doors (Doors 105, 160, 210, and 310) that are located in these barriers are in very good shape. They close properly, the latches are functionable and the hinges are still securely mounted to both the door and the frame. These metal doors which range from 1¾-in. to 2-in. have a similar type construction to that of a Class A or B Labeled Fire Door. A Class B Labeled Fire Door has a fire resistance rating of 1½-hr and a Class A rated door has a 3-hr rating. A 3-hr rated fire door has a similar exterior appearance to that of a 1½-hr fire door. It is anticipated from past analysis of actual labeled fire doors that the 1¾-in. and 2-in. metal doors that do not have a louver or a window will provide sufficient fire resistance. However, the metal doors (Doors 12, 104, and 115) that contain a plexiglass or regular glazed window, or have louvers will not provide adequate separation.

The HVAC duct penetrations through the barrier are limited in number. Per conversations with facility personnel, these ducts are no longer being used. However, these ducts are constructed of more than a standard sheet metal duct. These ducts are built of a heavy gauge metal and the joints are bolted together. A standard sheet metal duct is permitted to penetrate a 1-hr barrier without a fire damper. If a standard duct penetrates a 2-hr barrier, a fire damper is required. Since these ducts are bolted together and built of a more substantial construction than a standard sheet metal duct, it could be expected that they are adequate for a 2-hr barrier. However, since these ducts are no longer in use, it is recommended that they be disconnected at the barrier and the penetration be adequately sealed.

There are many miscellaneous pipe and conduit penetrations through these barriers. Many of these penetrations were poured-in-place at the time of construction. However, there are several penetrations that were not poured-in-place and adequate firestopping to limit the spread of fire is not in place. It is recommended that these unsealed penetrations be firestopped with an approved firestopping material. The poured-in-place penetrations appear to be adequately sealed to limit the spread of fire and are not a concern.

The majority of the 112 6-in. access ports that penetrate the barrier on the back-face of the reactor are sealed with a rolled metal tube filled with concrete, with the few exceptions being used for instrumentation tubing, pipes or conduits. Two 14-in.-long plugs are placed in each access port that is not being used for instrumentation tubing, pipes or conduits. There is a ⅜-in. steel plate welded on the end of each plug that overlaps the face of the barrier. Since these plugs are 14-in. long and two plugs are placed in these ports, it is expected that these will provide a minimum of 2-hr fire resistance. However, the ports that are used for instrumentation tubing, pipes, or conduits should be firestopped with an approved firestopping material.

The two viewing windows that are in the back-face of the reactor barrier are a oil-filled window that is approximately 3-ft thick. There is a 1-in. thick piece of glass on two sides, with oil between the two pieces of glass. It is unknown exactly what type of oil was used, but based upon past experience the oil is a type of mineral oil. Based upon similar fire testing that was completed by Factory Mutual (FM), these windows will withstand a minimum of 2-hr fire resistance rating.

The current arrangement of these barriers are not adequate to be classified as rated fire barriers. However, due to the construction of the barrier and the proposed upgrades as listed in Section 8.0, these barriers can be classified as an equivalent fire resistive barrier of 2-hr.

7.0 REQUIREMENTS FOR THE BARRIER

The following is the results of a compliance review to determine the required fire resistance rating for the barriers that are separating the active areas from the inactive areas.

DOE Orders:

DOE Order 5480.7A - There are two specific requirements for fire barriers in DOE Order 5480.7A. The first requirement is for a 3-hr barrier to limit the Maximum Possible Fire Loss (MPFL) to $150 million. The second is that fire areas shall be bounded by construction having a minimum fire resistance rating of 2-hr with openings protected by appropriately fire-rated doors, dampers, or penetration seals. The entire building has a value of less that $150 million so a 3-hr fire barrier is not required to limit the MPFL. These barriers are being used to separate the building into different fire areas. As a result of this separation the barriers are required to have a minimum fire resistance rating of 2-hr.

DOE Order 6430.1A - The General Design Criteria (DOE Order 6430.1A) is applicable for the design of new facilities and is not intended to be used to qualify existing buildings. This analysis was performed to determine what fire resistance rating would have to be, if the facility was being built today. Section 0110-6.3 requires that areas be divided so the total potential fire loss to each area and its equipment does exceed $75 million. These areas shall be divided by a 4-hr barrier. The total potential fire loss may exceed $75 million on the active side of the barrier primarily because of the contamination clean-up costs, resulting in a required 4-hr barrier. However, since the facility is an existing facility, this Order does not specifically apply, except when modifications are performed. However any building modifications shall be designed and built in accordance with DOE Order 6430.1A.

American Nuclear Insurers (ANI):

American Nuclear Insurers Fire/All-Risk Guidelines - The guidelines used by ANI state that "An approved fire barrier of 3-hr fire resistance rating with single automatic Class "A" fire doors, with rating of three hours and 250 degrees Max. 30 Min. Temp. Rise, at all necessary barrier openings should be provided to cut-off the following areas: All buildings such as Turbine, Reactor Containment, Auxiliary, Fuel Handling,..." Based upon these guidelines, ANI would recommend that the barrier separating the reactor areas from the active areas have a minimum fire resistance rating of 3-hr.

NFPA Codes and Standards:

NFPA 101,.*Life Safety Code* - The *Life Safety Code* classifies a reactor building as a special industrial occupancy. Section 6-4.1 requires that any area having a higher degree of hazard greater than that normal to the general occupancy of the building shall be separated by 1-hr, provided with automatic sprinklers or both. Keeping in mind that the Life Safety Code is a standard that is design for the safety of the occupants and not for property protection a fire resistance rating greater than 1-hr is not usually required.

NFPA 801, *Recommended Fire Protection Practice for Facilities Handling Radioactive Materials* is a recommend practice and not a standard. This recommend practice is intended to reduce the risks of fire and explosions at facilities handling radioactive materials. Section 3-4 recommends that the facility be subdivided into separate fire areas. The appendix of this section recommends that these separation barriers be of 3-hr fire resistance unless a fire hazards analysis indicates otherwise.

Factory Mutual Data Sheets:

Factory Mutual has no specific criteria for the required separation between the reactor areas and the active areas. However, FM does publish several Loss Prevention Data Sheets that address the construction requirements for fire barriers and for the firestopping of penetrations.

Summary of Compliance Requirements:

The information provided above is inclusive of mandatory requirements and recommended practices. The requirements from DOE Order 6430.1A does not specifically apply since it is not a new facility, but any building modifications shall be designed and built in accordance with this Order. Since NFPA 801 is a recommended practice, it is not a requirement that the barrier have a 3-hr fire resistance rating. The most restrictive mandatory requirement that apply for this facility is the separation requirement for fire areas as required by DOE Order 5480.7A. This separation requirement is to provide a 2-hr fire resistive separation between fire areas. This is the most restrictive requirement and it is recommended that the barriers be upgrade to provide a 2-hr fire resistive separation or equivalent.

8.0 UPGRADE RECOMMENDATIONS

The following upgrades shall be performed for the following penetrations to bring these barriers equivalent to a fire resistive barrier having a minimum fire resistance rating of 2-hr The recommended upgrades are based upon sound engineering practice by a Registered Fire Protection Engineer.

105KE:

- The opening at column lines H-5 (Door 131) should be provided with a 1½-hr Listed fire door and frame. The door will have to be built out around the existing piping and then firestopped. The duct at this location should be disconnected, since it has been deactivated, and a portion removed so the door and frame can be installed.

- The solid metal door (Door 150) should be removed and the opening sealed with sufficient masonry construction to provide the required separation.

- The pair of metal doors (Door 159) should be replaced with a pair of 1½-hr listed fire doors to provide the required separation.

- The access ports that are being used for instrumentation tubing, conduit or piping shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The one new 6-in.-dia. penetration with one 4-in.-dia. and one 1-in.-dia. conduit passing through it that is not sealed which is located above Door 160 shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The ventilation ducts through the barrier at floor elevation 38-ft, 0-in. per the drawings shall be disconnected at the barrier and the opening sealed with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The 1½-in.-dia. open conduit penetration, located at column line L-3, elevation 0-ft, 0-in. shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- Since Doors 104 and 115, has a plexiglass window and there are several penetrations in the door frame, the entire door and frame shall be replaced with a UL Listed Fire Door having a fire resistance rating of 1½-hr.

- The three unsealed 2½-in.-dia. pipe penetrations to the east of the control room Door 105 shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The duct in the area of the control room near Door 105 should be disconnected from the barrier and the opening sealed with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- A 10-in.-dia. pipe penetration for a sanitary sewer line located north of column line M and 2 at elevation below 0-ft, 0-in. shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The 6-ft by 7-ft, 8-in. opening in the barrier at approximately column L-5 which is identified as Door 28 on the drawings shall be sealed with a UL Listed Fire Door having a fire resistance rating of 1½-hr.

- The 1-ft by 5-ft, 8-in., opening for piping and conduits above the opening at column L-5 (Door 28) shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The two ducts that penetrate the barrier along column 5 at elevation below 0-ft, 0-in. should be removed and the openings sealed with an approved firestopping material.

- The four 3-in.-dia. unsealed pipe penetrations near the entrance door (Door 27) shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- Door 12 into the Tool Dolly/Machine Room shall be replaced with a UL Listed Fire Door having a fire resistance rating of 1½-hr.

<u>105KW:</u>

- The opening at column lines H-5 (Door 131) should be provided with a 1½-hr Listed fire door and frame. The door will have to be built out around the existing piping and then firestopped. The duct at this location should be disconnected, since it has been deactivated, and a portion removed so the door and frame can be installed.

- The solid metal door (Door 150) should be removed and the opening sealed with sufficient masonry construction to provide the required separation.

- The pair of metal doors (Door 159) should be replaced with a pair of 1½-hr listed fire doors to provide the required separation.

- The access ports that are being used for instrumentation tubing, conduit or piping shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The one new 6-in.-dia. penetration with one 4-in.-dia. and one 1-in.-dia. conduit passing through it that is not sealed which is located above Door 160 shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The ventilation ducts through the barrier at floor elevation 38-ft, 0-in. per the drawings shall be disconnected at the barrier and the opening sealed with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The 1½-in.-dia. open conduit penetration, located at column line L-3, elevation 0-ft, 0-in. shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- Since Doors 104 and 115, has a plexiglass window and there are several penetrations in the door frame, the entire door and frame shall be replaced with a UL Listed Fire Door having a fire resistance rating of 1½-hr.

- The 1-in.-dia. sprinkler pipe that penetrates the barrier adjacent Door 105 shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The three unsealed 2½-in.-dia. pipe penetrations to the east of the control room Door 105 shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The duct in the area of the control room near Door 105 should be disconnected from the barrier and the opening sealed with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- A 10-in.-dia. pipe penetration for a sanitary sewer line located north of column line M and 2 at elevation below 0-ft, 0-in. shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The 6-ft by 7-ft, 8-in. opening in the barrier at approximately column L-5 which is identified as Door 28 on the drawings shall be sealed with a UL Listed Fire Door having a fire resistance rating of 1½-hr.

- The 1-ft by 5-ft, 8-in., opening for piping and conduits above the opening at column L-5 (Door 28) shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- The two ducts that penetrate the barrier along column 5 at elevation below 0-ft, 0-in. should be removed and the openings sealed with an approved firestopping material.

- The four 3-in.-dia. unsealed pipe penetrations near the entrance door (Door 27) shall be firestopped with an approved firestopping material sufficient to maintain the integrity of a 2-hr barrier.

- Door 12 into the Tool Dolly/Machine Room shall be replaced with a UL Listed Fire Door having a fire resistance rating of 1½-hr.

- Door 27 into the basement area at column line J.e-5 shall be replaced with a UL Listed Fire Door having a fire resistance rating of 1½-hr.

9.0 REFERENCES

9.1 FACILITY DOCUMENTATION

WHC, 1994, *Engineering Study for 100K Area Fire Protection Upgrades*, WHC-SD-N037-ES-001, March 1994, Westinghouse Hanford Company, Richland, Washington.

9.2 DRAWINGS

H-1-21000 Drawing Index Architectural and Structural

H-1-21001 Architectural Key Plan at Elev. 0-ft, 0-in.

H-1-21002 Architectural Floor Plans Below 0-ft, 0-in. and Below -17-ft, 6-in., Process Area

H-1-21004 Architectural Floor Plan at Elev. 0-ft, 0-in. Process Area

H-1-21005 Architectural Floor Plan at Elev. 15-ft, 0-in. Process Area

H-1-21006 Architectural Floor Plan at Elev. 28-ft, 0-in. Process Area

H-1-21007 Architectural Floor Plan at Elev. 0-ft, 0-in. Storage and Transfer Area

H-1-21008 Architectural Floor Plan at Elev. 15-ft, 0-in. Storage and Transfer Area

H-1-21009 Architectural Floor Plan at Elev. 28-ft, 0-in. Storage and Transfer Area

H-1-21010 Architectural Floor Plan at Elev. 38-ft, 0-in. Storage and Transfer Area

H-1-21011 Architectural Floor Plan at Elev. 51-ft, 7-in. Process Area

H-1-21012 Architectural Floor Plans at Elev. 66-ft, 0-in. and 90-ft, 2-in.

H-1-21016 Architectural Transverse Section, Process Area

H-1-21017 Architectural Cross-Section, Process Area

H-1-21019 Architectural Cross-Section at Column 11.8

H-1-21020 Architectural Cross-Section at Column 6

H-1-21021 Architectural Cross-Section at Column 15

H-1-21022 Architectural Transverse Section at Column 14.6

H-1-21023 Architectural Cross-Section at Column 3

H-1-21024 Architectural Elevations

H-1-21025 Architectural Door Schedule

H-1-21026 Architectural Typical Door Details

H-1-21038 Architectural Plans, Sections and Details, Stairs 5 and 6

H-1-21056 Structural Concrete Floor Plan at Elev. 0-ft, 0-in. Process Area

H-1-21057 Structural Concrete Floor Plan and Sections Below Elev. 0-ft, 0-in. Storage and Transfer Area

H-1-21059 Structural Concrete Floor Plan at Elev. 28-ft, 0-in. Process Area

H-1-21060 Structural Concrete Floor Plans at Elev. 15-ft, 0-in. and 28-ft, 0-in. Storage and Transfer Areas

H-1-21082 Structural Concrete Sections and Details above Elev. 0-ft, 0-in. Process Area

H-1-21084 Structural Concrete Sections and Details above Elev. 0-ft, 0-in. Process Area

9.3 DOE ORDERS AND CRITERIA

DOE Order 6430.1A, *General Design Criteria*, 1989.

DOE Order 5480.7A, *Fire Protection*, 1993.

RLID 5480.7, *Fire Protection*, 1994.

9.4 NATIONAL FIRE PROTECTION ASSOCIATION CODES/STANDARDS

NFPA 80 - *Standard for Fire Doors and Fire Windows*, 1992.

NFPA 101 - *Life Safety Code*, 1994.

NFPA 220 - *Standard Types of Building Construction*, 1992.

NFPA 252 - *Standard Methods of Fire Tests of Door Assemblies*, 1990.

NFPA 801 - *Recommended Fire Protection Practice for Facilities Handling Radioactive Materials*, 1991.

9.5 FACTORY MUTUAL LOSS PREVENTION DATA SHEETS

Loss Prevention Data Sheet 1-19, *Fire Walls, Subdivisions and Draft Curtains*, June 1991.

Loss Prevention Data Sheet 1-21, *Fire Resistance Building Assemblies*, July 1977.

Loss Prevention Data Sheet 1-23, *Protection of Openings*, August 1976.

9.6 OTHER DOCUMENTS

DOE *Fire Protection Resource Manual.*

NFPA *Fire Protection Handbook*, 17th Edition.

SFPE *Fire Protection Engineering Handbook*, First Edition.

American Nuclear Insurers Fire/All-Risk Guidelines, November 1990.

Fire Resistive Directory - Vol. I, Underwriters Laboratories, Inc. 1993.

Uniform Code For Building Conservation, (UCBC) International Conference of Building Officials, 1991 Edition.

APPENDIX A

Resume for John W. Poole, III "Jack"

P.E. Certifications for John W. Poole, III

JOHN WILLIAM POOLE, III, P.E.
(JACK)

20475 South Woodland
Spring Hill, KS 66083

Telephone: (913) 592-3823
Birth Date: Dec. 16, 1963

AREAS OF COMPETENCE:

Fire Protection Engineering: Detection and suppression system design, including fire inspection and testing activities, fire protection audits and loss prevention surveys, design reviews, hydraulic calculations, life safety evaluations, water supply analysis, code compliance surveys, and computer fire modeling.

REGISTRATIONS:

Professional Engineer, State of Kansas, #12095.
Professional Engineer, State of Missouri, #E-25232.
Member Grade, Society of Fire Protection Engineers (SFPE).
Department of Energy (DOE), Security "Q" Clearance.

- Active at AlliedSignal, Kansas City Division and Martin Marietta - Y-12 Plant, Oak Ridge.
- Clearance # AB-198208, Date Received: April 8, 1988.

EDUCATION:

Bachelor of Science Degree, Fire Protection Engineering, University of Maryland, College Park, 1986.

EXPERIENCE:

July 1991 - Present

President, Poole Fire Protection Engineering, Inc. Provide fire protection engineering consulting and design services to architectural/engineering firms, consultants and the industry. Extensively involved in design of fire suppression/detection, and special hazard extinguishing systems and life safety components; and in performing fire protection/life safety audits/surveys. Through frequent contact with architectural/engineering firms, insurance representatives, building code officials, fire departments, regulatory agencies, and other authorities having jurisdiction, a "practical" approach to conventional fire protection concerns, as well as those unique to specialized industries is provided. The professional courtesy maintained with these organizations, provides the assurance that the client will receive the maximum design flexibility, combined with effective and economical fire protection and life safety.

- Westinghouse Hanford Company, Hanford Site, Richland, Wash. - Developed a Fire Hazards Analysis (FHA) for Columbia Energy & Environmental Services to support Westinghouse Fire Protection Programs at the Plutonium Concentration Facility. This FHA was prepared to address the Decontamination and Decommissioning (D&D) activities for this facility.

- Westinghouse Hanford Company, Hanford Site, Richland, Wash. - Developed a Fire Barrier Evaluation Report for Columbia Energy & Environmental Services to support the Westinghouse Projects Organization at the K-Area Reactor Buildings. This report is to document the current conditions of the barriers and develop corrective actions to upgrade the barriers.

Jack Poole, P.E.

- Westinghouse Hanford Company, Hanford Site, Richland, Wash. - Developed two FHA's for Los Alamos Technical Associates to support the Solid Waste Retrieval and Storage Projects. The first FHA was for the facilities and the retrieval process of low level solid waste. The second FHA was for the Phase V Storage Facilities with primary emphasis on the automated stacker/retriever facility. These FHA's were prepared in accordance with applicable DOE Orders, Federal and local codes, and National Fire Protection Association (NFPA) Codes and Standards.

- Martin Marietta Energy Systems, Y-12 Plant, Oak Ridge, Tenn. - Worked with PAI Corporation to perform Fire Protection Engineering Assessments at the Y-12 Plant. This work consisted of surveying 181 buildings and the development of 96 Fire Protection Engineering Assessment Reports. The 181 buildings were reviewed for compliance with all applicable NFPA Codes and Standards, DOE Orders, and Factory Mutual Loss Prevention Data Sheets.

- AlliedSignal Aerospace Company, Kansas City, Mo. - Provided engineering support services to the Facilities Engineering Department to verify the field conditions against project as-built drawings, and collect the necessary data to maintain the Intergraph Plant Model Sprinkler Module. The work also required that any code deficiencies be identified to the Fire Protection Engineering Department.

- Federal Bureau of Prisons - Performed Life Safety/Fire Protection Surveys for 11 federal prisons across the United States. The project included an in-depth survey of each institution with respect to all applicable NFPA Codes and Standards and the Federal Bureau of Prisons Policies. A report for each institution was developed to identify the deficiencies and to generate a priority, recommended corrective action and a cost estimate for each deficiency.

- Federal Bureau of Prisons - Developed and taught a three day Fire Protection/Life Safety Training course for the Safety Managers of the Federal Bureau of Prisons. This course was presented to four separate classes, in conjunction with the five week Safety Manager training course.

- General Accounting Office, Washington, DC - Performed a detailed design for a complete fire alarm system for the General Accounting Office. The design included a multiplexed fire detection, alarm, and emergency voice notification system. Prior to the design of the fire alarm system, I assisted in the development of a FHA of the facility.

- Have been approved and accepted as a qualified Fire Protection Engineer by Oak Ridge Associated Universities/Oak Ridge Institute for Science and Education (ORAU/ORISE), to perform Technical Safety Appraisals (TSA), Safety Analysis Reviews (SAR), or FHA for the Department of Energy.

- Westinghouse Idaho Nuclear Company (WINCO), DOE Idaho National Engineering Laboratory (INEL) - Performed Pre-Technical Safety Appraisal engineering support for Systems Engineering. Evaluated and provided corrective action for 200 fire protection work orders which involved various types of DOE Order and NFPA Code deficiencies. The evaluations consisted of suppression and detection system modifications, life safety analyses, and exit signage and emergency lighting placement recommendations for facilities at

WINCO. Developed the criteria for preparing FHA's at the WINCO site. This criteria included the minimum requirements and the methodology of how a FHA is to be prepared. Developed the criteria for preparing as-built fire protection drawings and the format for which are to be entered into the Computer Aided Drafting (CAD) system. The criteria included a description of a system components, the accuracy requirements for measuring the components, and the level scheme for entering the information into CAD.

- Chrysler Technologies, Waco, Tex. - Performed a facility walkthrough and evaluation of an existing aircraft hangar, identified the requirements, and developed a cost estimate for compliance with NFPA 409 and the Air Force ETL 90-09. This information was used to determine if it would be cost effective to purchase the existing hangar and bring it into compliance with the codes or to construct a new hangar.

- DOE Savannah River, Aiken, S.C. - Sub-contracted by PAI Corporation to review two separate FHA's for the Savannah River Site.

- General Electric Neutron Devices Division, DOE Pinellas Plant - Developed 21 individual fire brigade lesson plans. These lesson plans were developed to train all fire brigade members how to handle emergency fire situations and control and extinguish various types of fires at the plant.

- General Electric Neutron Devices Division, DOE Pinellas Plant - Developed a complete fire protection program for the facility to be used as a guideline for all life safety and fire protection concerns at the plant.

- General Electric Neutron Devices Division, DOE Pinellas Plant - Assisted in the development of construction safety, electrical safety, pressure system safety, and equipment commission programs for the facility to be used as a guideline for all respectively safety concerns at the plant.

June 1986 - October 1991 Fire Protection Engineer, Black & Veatch Engineers-Architects, Facilities Group. Provide overall building construction, life safety and the overall fire protection criteria for both Federal, Industrial, and Cogeneration Projects at Black & Veatch. Leadership responsibilities include Project Manager, Project Engineer, and Lead Fire Protection Engineer to administer, coordinate with other engineering disciplines, and provide a team effort to the various projects. Project responsibility includes design and/or review of the fire protection design, including suppression and detection systems, life safety components, and building construction; preparation of specifications; equipment, systems and component submittal review; life safety and egress studies; water supply distribution studies; NFPA fire code and model building code compliance studies; computer fire modeling; and fire protection estimating.

June 1985 - Sept. 1985 Fire Protection Engineer, American Electric Power Service Corporation, Columbus, Ohio. Responsibilities include the design and review of many fire suppression and detection systems for the Donald C. Cook Nuclear Power Plant; and assisted in the development of a Fire Hazard Analysis for the Cook Nuclear Power Plant.

Nov. 1983 - June 1984 Physical Science Technician, National Bureau of Standards, Center for Fire Research, Gaithersburg, Maryland. Responsibilities included conducting many large and small scale fire tests; and developed a standard reference material for the Flooring Radiant Panel, ASTM E-84.

Jack Poole, P.E.

PROFESSIONAL DEVELOPMENT:

- NFPA Life Safety Code Workshop.
- NFPA Fire Alarm and Detection Workshop.
- NFPA Automatic Sprinkler Workshop.
- Fire Department Hands-On Training.

Fire Department Organization	Extinguishers and Ropes
Fire Hose Practices	Hazardous Materials
Fire Apparatus Pumping Practices	Ladder Practices
Advanced First Aid and CPR	Water Supplies
Defensive Driving	Arson and Fire Cause
Combined Operations	Railway Accidents
Forcible Entry	Subway Accidents and Rescue
Salvage and Overhaul	Ventilation Practices
Tanker Operations	Fire Inspections
Extraction Practices	Pumping and Hydraulics
Self-Contained Breathing Apparatus	

PROFESSIONAL ORGANIZATIONS/CERTIFICATIONS:

- Professional Engineer (PE), State of Kansas and Missouri.
- NFPA/National Fire Protection Association.
- Principal Member, NFPA Airport Facility and Helicopter Facility Technical Committees.
- SFPE/Society of Fire Protection Engineers:
  National (Member Grade), and MO-KAN Chapters.
- National SFPE, Education Committee Member.
- MO-KAN Chapter, Past President (1993).
- MO-KAN Chapter, Education Committee Chairman.
- ICBO/International Conference of Building Officials.
- American Red Cross, Basic First Aid and CPR.

EXTRA CURRICULAR ACTIVITIES:

Nov. 1993 - Present	• Board Member, South County Volunteer Firemans Relief Association
Oct. 1992 - Present	• Board of Director, South Johnson County Volunteer Fire & Rescue Department, Inc.
July 1992 - Present	• Assistant Chief of Prevention, South Johnson County Volunteer Fire & Rescue Department, Inc., Johnson County, Kansas
June 1992 - Present	• Certified Private Pilot
Nov. 1991 - Present	• Member, Spring Hill Chamber of Commerce
Oct. 1991 - 1992	• Member, Spring Hill Fall Festival Committee
Nov. 1988 - 1992	• President, Spring Hill Firemans Relief Association
1987 - 1993	• Fireman, Spring Hill Fire-Rescue Department, Inc., Spring Hill, Kansas • Vice President, Spring Hill Fire-Rescue Department, Inc., Board of Directors • 4-H Woodworking Leader, Sharon 4-H Club
1986 - Present	• Inactive Member, Jarrettsville Volunteer Fire Department, Jarrettsville, Maryland

Jack Poole, P.E.

	•	Inactive Member, Silver Spring Volunteer Fire Department, Silver Spring, Maryland
	•	National 4-H Allstar
1985 - 1986	•	President, SFPE, University of Maryland, Student Chapter
1983 - 1986	•	Fireman, Silver Spring Volunteer Fire Department
1979 - 1986	•	Fireman, Jarrettsville Volunteer Fire Department
1972 - 1981	•	President, Vice President, Secretary and Treasurer of Several 4-H Clubs

PROFESSIONAL/PERSONAL
REFERENCES: Available upon request.

Jack Poole, P.E.

P.E. Certifications for John W. Poole, III