LICENSEE'S EXHIBIT 4

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judge
Peter B. Bloch

In the Matter of THE CURATORS OF THE UNIVERSITY OF MISSOURI (Byproduct License No. 24-00513-32; Special Nuclear Materials License No. SNM-247)	Docket Nos. 70-00270 30-02278-MLA RE: TRUMP-S Project ASLBP No. 90-613-02-MLA

AFFIDAVIT OF CHESTER B. EDWARDS, JR.
REGARDING THE ADEQUACY OF ALPHA LABORATORY EQUIPMENT,
FIRE-RELATED FEATURES IN THE ALPHA LABORATORY
AND GENERAL BASEMENT AREA,
AND THE STORAGE AND TRANSFER OF ACTINIDE AND ARCHIVED MATERIALS

I, Chester B. Edwards, Jr. being duly sworn, hereby state as follows:

1 I am the Facilities Manager for the University of Missouri Research Reactor (MURR), a position that I have held since March 1, 1989.

2 I received an Associate's Degree in Applied Electronic Technology and Design (AAS) in 1962 from DeVry Technical Institute, Chicago, Illinois and a B.S. from the College of Education, Industrial Education, in 1975 from the University of Missouri-Columbia.

3 I have been employed at MURR since 1968 in positions of Reactor Operator (1968), Senior Reactor Operator (1968-1975), Maintenance Engineer (1975-1989) and presently Facilities Manager. I currently hold an NRC Senior Reactor Operator License (SRO) and have a total of 28 years of research reactor and research program support experience. I am a member of the

"Facility Emergency Organization" as defined in the NRC approved MURR Emergency Plan.

4 Prior to my employment at the MURR, I was employed with the Reactor Operations Division (1962-1968) at the Argonne National Laboratory, Argonne, Illinois. My resume is attached as Attachment 1.

5 As Facilities Manager, it has been my responsibility to coordinate and provide oversight for the Alpha Laboratory design and construction, equipment installation and testing, and development of the TRUMP-S procedures. I have also been a team member of the TRUMP-S Program oversight committee. This committee meets weekly with the Project Principal Investigator and his colleagues and MURR staff from the Director's Office, Health Physics, Reactor Operations and Facilities Management.

6 My support staff includes two (2) staff engineers, one of whom has been assigned a major responsibility for this project, two (2) electronic technicians, four (4) machinists/instrument builders and one (1) drafting person.

7 I was the University's Coordinator and principal contact with the Rockwell International (Rockwell) and was responsible for assessing the TRUMP-S Research Program laboratory and research equipment requirements. This included detailed reviews and discussions with Rockwell staff concerning design and construction features of the Alpha Laboratory and the design specifications of research equipment provided by Rockwell. My responsibilities also included the development of the Alpha Laboratory's research equipment installation requirements, operational features and the readiness performance testing and certifications for the Alpha Laboratory and its equipment.

8 I was MURR's liaison with Architectural Engineering (A/E) consultant retained by the Licensee to assist in the Alpha Laboratory room design. The A/E services included room construction details, Heating, Ventilation and Air Conditioning (HVAC) design, electrical and utility services design. I also coordinated the University's Campus Facilities construction trades (carpenters, plumbers, electricians, sheet metal workers, painters, etc.) who actually built the Alpha Laboratory.

9 I chaired the weekly meetings for Alpha Laboratory construction phase of the project. Attendees included Campus Facilities Engineering and Construction Management staff, construction trades supervisors (the project construction phase determined which trade supervisor(s) attended) and MURR staff from Facilities Management, Reactor Operations and Health Physics.

10 I have reviewed and approved all of the Facility and Maintenance Procedures sections 80 through 91 of the TRUMP-S Actinide Measurements (TAM) Standard Operating Procedures.

11 Hence, I am qualified by background, experience and personal knowledge to attest to the adequacy of the equipment in the Alpha Laboratory, as well as the features of the Alpha Laboratory and general basement area to limit the spread of fire and the transportation and storage of TRUMP-S nuclear materials.

The Equipment in the Alpha Laboratory
has been Adequately Inspected and Tested

12 The contents of the Alpha Laboratory are primarily limited to non-combustible research equipment systems, other research equipment and miscellaneous items, as described below.

13 The research equipment systems for conducting the TRUMP-S experiments consist of:

a Ni Train System
b Dri Train System
c ICP System
d ICP Plasma Source
e ICP Power Supply
f. ICP Computer
g. Thermal Well Heater and Controller
h. Data Acquisition System and Printer
i. Computer Terminal, CPU and Printer
j. Drying Oven
k. Alpha 3 Radiation Air Monitor

Each of these stand alone systems are housed in their respective metal cabinets (except f and i which have molded plastic cabinets) and contain a specialized array of electrical, electronic, and mechanical components to accomplish their intended purpose. Each cabinet has at least one electrical fuse and/or electrical breaker, and each of the laboratory electrical services is equipped with safety trip protection that meets the National Electrical Code for service.

14 The other research equipment consists of:

a Argon glove box and associated equipment and systems. The argon glove box includes a stainless steel box with antechamber, a view window on each side, four glove port holes with rubber gloves, and port covers. One of the argon glove box windows is made of polycarbonate polymer (Tuffak Plastic manufactured by Rohm and Haas Co.) with a NFPA flammability rating of 1. The other windows are made of a self extinguishing acrylic resin (SE-3 manufactured by Rohm and Haas Co.).

b Air glove box and associated equipment and systems. The air glove box includes an aluminum box with an antechamber connecting the air glove box to the argon box, view windows with four rubber glove ports, one bag out port, and port covers. The windows for the air glove box are made of polycarbonate resin (Lexan Resin manufactured by General Electric) and has a NFPA flammability rating of 1.

c ICP glove box and associated equipment and systems. The ICP glove box includes an aluminum frame box with view windows with three rubber glove ports, one bag out port, and port covers. The ICP glove box windows are made of a polycarbonate polymer (Tuffak Plastic manufactured by Rohm and Haas Co.) with a NFPA flammability rating of 1.

As indicated above, none of the glove boxes are constructed of materials that are a source of fuel. All three glove boxes are of metal construction. The windows are made of polycarbonate polymer, acrylic resin or polycarbonate resin. In the event of a fire, one type is rated self extinguishing and the other two are rated NFPA as 1 (slight), none of which is likely to burn. Each has installed Butyl rubber gloves that are designed especially for glove box service and are universally used in the chemical and nuclear industries. The Butyl rubber gloves have a flash point of 482° F. The argon glove box has installed a heat sensor fuse link as part of the fire protection alarm system. The fuse link is Underwriters Laboratory (UL) approved to melt at 136° F and activate the fire alarm system. Meyer Affidavit October 29, 1990, ¶ 28. At all times, except when researchers are working in the glove boxes, the port covers are bolted in place over the glove port opening. The glove port covers for the argon glove box are made of molded phenolic resin, an insulator commonly used in the electrical/electronic industry that does not burn. The port covers for the air glove box and the ICP glove box are made of aluminum plate.

15 The major miscellaneous items within the Alpha Laboratory consist of:

a Metal Desk
b Office chair and lab stools
c One Vacuum Pump
d One Radiological Air Filtering System with Roots Blower
e Health Physics Hand Held Survey Instruments and Cart
f Fire extinguishers

g Two telephones

h Necessary Laboratory and office supplies

16 The equipment in the Alpha Laboratory (each glove box, support equipment and plumbing/ventilation system components) has been selected, installed and tested to reduce undesired experimental interference with the quality of collected research data.

17 All the major research equipment in the Alpha Laboratory (Argon glove box, with Ni and Dri train units, air glove box, ICP system, data acquisition instruments, oven) and their instrument tech manuals were transferred to the Licensee by Rockwell International. Upon receipt of this equipment and their instrument tech manuals, the Licensee completed an inventory check of all items. Each piece of research equipment was inspected and approved for use by Licensee staff prior to installation. Each piece of equipment was verified operable by Licensee staff in accordance to general standard operating practices, manufacture's technical and operational specifications, system performance criteria developed for conducting the research and the Facility and Maintenance TRUMP-S procedures (TAMs 80 through 91).

18 All of the operational controls, electrical, electronic, and mechanical components for each piece of research equipment in the Alpha Laboratory (including the argon glove box and support equipment) have been inspected, installed, calibrated and operationally tested to perform within the TAM's and good research practices. All safety actuated trips and associated response equipment have been operationally tested to perform within the TAM's and standard operational practices.

19 The Alpha Laboratory operation and research equipment operational and safety calibrations, functional tests and operational limits are recorded. Prior to authorization of the TRUMP-S research to begin, all research equipment and laboratory readiness tasks were completed and certified by a member of the TRUMP-S oversight committee. The final review, acceptance and approval of these tasks was performed by the principal investigator and the Associate Facility Director.

The Alpha Laboratory has been Constructed to Minimize the Spread of Fire

20 The Alpha Laboratory has been constructed so as to minimize combustibility of floor, walls and ceilings. The Alpha Laboratory has approximately 450 sq. ft. of floor area, 8 ft. ceiling, constructed with 2 in. x 4 in. walls and 2 in. x 12 in. ceiling joist. The walls and ceiling are fiberglass insulated for sound proofing, with 5/8 in. Gold Bond fire code Type X

drywall, which has a one (1) hour fire rating and meets ASTM C-36-85 and FED. STD SS-L-Type-30D codes. The walls and ceiling are completely covered with one coat of primer and two coats of epoxy two part paint.

21 The floor covering is a seamless 80 mil thick Armstrong Medinteck vinyl which meets National Fire Protection Association (NFPA) Life Safety Code 101. The flooring has a smooth finish, is chemical resistant, and extends up 4 inches on the wall.

22 The Alpha Laboratory has three access solid core doors (each with a fire rating of 20 minutes). One is designated as an emergency exit which also may be used to pass large equipment through. By design, the Laboratory cannot be accessed through the emergency exit door. The emergency exit door may only be opened from inside the laboratory. The other two doors are part of an airlock pass through for normal personnel entry and exit. All three doors are equipped with surface mount rubber gasket seals which are mechanically activated when placed in the closed condition. Each of the airlock doors has a view window to observe who is in the area. A sealed plate glass window is installed in the south wall to allow observation of activities inside the Alpha Laboratory for safety purposes.

23 Other features of the Alpha Laboratory that would minimize the effects of any fire or explosion that occurs in the Laboratory have been described in the Meyer Affidavit October 29, 1990, at ¶¶ 24 - 31, 44, 45, 47, 59, 66, and 67.

24 The Alpha Laboratory ventilation and exhaust systems are designed so that, in the event of a fire, the air supply exhaust fans can be turned off, and the supply and exhaust dampers closed.

25 The Alpha Laboratory ventilation is designed to control the air supply and exhaust volumes and the negative laboratory room pressure. The ventilation system for the basement/Alpha Laboratory has one supply line and three exhaust lines. The facility exhaust system discharges all the exhaust air from the three basement/Alpha Laboratory lines, grade level quadrant laboratory HEPA filtered trunk lines and the containment building.

26 The ventilation for the Alpha Laboratory is supplied from the HVAC double duct system on grade level. Supply from Supply Fan-1 (SF-1) provides treated air (site steam heated and chill water cooled) to the basement via mixing boxes that are controlled for comfort by the room thermostat. The Alpha Laboratory has its own mixing box and booster supply fan to supply treated DOP tested HEPA (filter meets UL 586 High-Efficiency Particulate, Air Filter Units standard) filtered air.

A damper is installed between the mixing box and HEPA filter that may be used to balance air flows or may be placed in the closed position to isolate the Alpha Laboratory. Either or both of the supply fans (SF-1 and the Alpha Laboratory fan) may be turned off in the event of a fire.

27 The Alpha Laboratory exhaust air system has installed two pre-filters in parallel followed by two parallel DOP tested HEPA filters which is followed by two more DOP tested HEPA filters in parallel. The laboratory exhaust inline fan booster discharges into the existing MURR facility exhaust system prior to the facility exhaust exiting the building. The exhaust system installed damper may be used to balance the air flow or may be placed in the closed position to isolate the Alpha Laboratory. The exhaust fan may be turned off in the event of a fire.

28 The Hot Cell, located in the basement area, is exhausted via two HEPA filters in series, followed by an inline booster fan system located in the inner corridor on grade level. The hot cell booster exhaust fan discharges into the facility exhaust system. The hot cell exhaust may be isolated by a quick closing, air to open, spring to close butterfly valve on actuation. This valve may be placed in the closed position during a fire.

29 Mechanical equipment room 114 exhaust air passes through two HEPA in parallel followed by two charcoal filters in parallel, all of which are located in the room 278 area on grade level. The room 114 filter housing is connected to the facility exhaust system.

30 The Alpha Laboratory, Hot Cell and room 114 exhaust air combines with exhaust air from the four (4) laboratory quadrants and the containment building and is exhausted via the facility exhaust fan at least 55 ft. (R-103 license specification) above grade level (actual height is 68 ft.). The facility exhaust system has one fan in operation with a second in auto start stand by. Both fans have emergency electrical generator back up. Both exhaust fans may be turned off during a fire incident.

The General Basement Area is Constructed
<u>to Minimize the Spread of Fire</u>

31 As previously described the Alpha Laboratory was constructed to minimize the possibility of a fire spreading from within the Alpha Laboratory to the basement area. Even if this were to occur, the construction of the basement area is such that it would prevent the spread of a fire any further. The Alpha Laboratory is housed in the basement area outside containment. The reinforced poured concrete vault in which the Alpha Laboratory is housed has a 12 in. thick concrete floor, 8 in.

thick concrete ceiling, and 16 in. thick concrete walls on the north, east, south and west. In effect, the Alpha Laboratory is entombed inside a concrete vault isolated from the rest of the facility.

32 The basement has no windows and two exit points. One is to the reactor mechanical equipment room 114 area, deeper in the basement and cooling tower tunnel. The cooling tower tunnel is secured by a metal door that is kept closed and locked at all times. The cooling tower tunnel door alarms locally and remotely in the reactor control room 302. Unauthorized access is responded to immediately by licensed Reactor Operators. The control room operator has video camera monitoring of this door. The second exit is up the stairs to grade level landing. The stairs landing is isolated from the grade level by two fire doors, one going in each direction leading to the inner and outer corridor.

33 The freight elevator from the basement to grade level is accessed via steel roll up doors on either side of the cargo box, one on the north side and one on the south side at basement level and one on the north side and one on the south side at grade level, for a total of four (4) doors. Both doors at one level or the other, depending on which level the cargo box is, are closed, isolating the basement from grade level. The operation of the elevator cargo box movements is both electrically and mechanically interlocked so at least one set of roll up doors are always in the closed condition.

The Materials in the General Basement Area do
<u>not Create a Fire Hazard to the Alpha Laboratory</u>

34 The general basement area (outside the Alpha Laboratory) does not present a hazard to the Alpha Laboratory from flammables, combustibles or explosives. There are no explosives, gasoline, diesel fuel, kerosene, fuel oil, motor oils, etc. stored in the basement. As described below, the basement area is served by a 15 ton hydraulic freight elevator and a natural gas system, and houses two hydraulic presses used for waste processing.

35 The 15 ton hydraulic freight elevator serves the basement area from grade level. The elevator hydraulic oil reservoir (hydraulic oil used is a mixture of Texaco-Rando oil HD-32 and Sun Oil - Sunvis 846 both with an NFPA flammability rating of 1) is a closed self-contained system in room 119 which is ≈ 80 ft. from the Alpha Laboratory and adjacent to the elevator shaft. Maintenance and operational inspections and testing are performed under contract by the Otis Elevator Company. Any oil leakage, etc. is repaired and cleaned up when it occurs.

36 A low pressure natural gas distribution piping system is installed throughout the facility. The gas system is installed according to standard building codes. The gas line safety valve and isolation shut-off valve for the facility supply is located outside the facility at the facility piping entry location and adjacent to the loading dock (in compliance with NFPA 802, Section 3-9.2). There is no natural gas line or supply in the Alpha Laboratory and the closest gas pipe is ≈ 15 ft. from the laboratory. There is no use of natural gas and no installed connection tees in this area. The closest area that uses natural gas is ≈ 85 ft.

37 Two hydraulic presses (hydraulic oil used is American Oil and Supply Company, H-537, with a NFPA flammability rating of 1) are housed in the basement for compacting Low Specific Activity (LSA) radioactive waste materials for shipment. A small self contained, enclosed reservoir hydraulic press for smashing LSA aluminum cans is located ≈ 85 ft. from the Alpha Laboratory. A larger hydraulic compactor, also a self contained, enclosed reservoir hydraulic ram press, is used for compacting LSA rad waste materials into Department of Transportation (DOT) approved 55 gallon metal drums for shipment. The compactor is located ≈ 80 ft. from the Alpha Laboratory.

38 Explosives are prohibited from being brought into the reactor facility, including the basement area and the Alpha Laboratory. Explosives of any type are not handled, used, stored or processed within MURR. Unnecessary combustibles are not stored in the basement area. Limited storage of latex gloves, absorbent paper, paper towels, computer paper, reference books, manuals, etc. are available in the basement stored in metal cabinets. Radioactive waste materials are collected throughout the facility and processed with the Low Specific Activity (LSA) waste processing compactor. These materials are processed on a regular basis and are not permitted to accumulate. Metal barrels (with lids), which are filled with compacted LSA materials, are stored in the basement area until picked up by the University contract commercial disposal firm.

The Actinides are Stored Inside Special Transport and Storage Containers

39 The actinides were shipped from the supplier (Rockwell International for the uranium, plutonium, neptunium, and the Department of Energy's (DOE) Oak Ridge Laboratory for the americium) in approved Department of Transportation (DOT) shipping containers. After receipt, the actinide materials were promptly stored in these containers in the Reactor Fuel Vault. The receipt of the material was controlled by the Special Nuclear Material (SNM) Custodian who was guided by TAM-20 "Receipt of

Actinides", and Health Physics Standard Operating Procedure HP-SOP-3 "Receiving and Opening Packages of Radioactive Material."

40 The actinides were subsequently moved to the argon glove box in the Alpha Laboratory in the original shipping containers by the SNM Custodian under the direction of procedure TAM-21, "Transfer of Actinides." (Only one actinide material was transferred to the Alpha Laboratory at a time.) The actinide shipping container was placed in the Argon glove box in accordance to TAM-12, "Glove Box Transfers." In the glove box the materials were removed from the original shipping containers. The material was then separated for use in experiments and the bulk inventory is placed in a series of four specialized containers in accordance to TAM-22 "Actinide Sample Subdivision and Storage" (each housed inside the other). As is described below, the actinides are stored in the Reactor Fuel Vault and transferred between the Alpha Laboratory and the fuel vault inside the series of four specialized containers.

41 After the actinides are used in the TRUMP-S experiments, the material is placed in two specialized containers (one housed inside the other) and placed in the "lead storage box." The transfer and storage of these archived materials are also discussed below. The actinides are stored and transferred in a controlled configuration that minimizes the risk of fire.

The Storage of Actinides in the Reactor Fuel Vault

42 All actinide materials are stored inside the Reactor Fuel Vault. The fuel vault is housed inside the Reactor Containment Building. The fuel vault is a specially constructed (combination of thick concrete walls and heavy steel plates) room with a single door and is secured by an appropriate lock.

43 The entry into the fuel vault is controlled in accordance with NRC approved security procedures.

44 The accountability of Special Nuclear Materials (SNM) is the responsibility of the SNM Custodian. The SNM Custodian receives and accepts TRUMP-S Radioactive Materials in accordance with TAM-20. The SNM Custodian completes a monthly physical inventory of SNM materials as required by TAM-23 "Inventory Control of Actinides." All transfers into and out of the fuel vault are recorded by the SNM custodian in the TRUMP-S Radioactive Materials log as required by TAM-21 "Transfer of Actinides".

Description of the Storage Containers

45 A series of four (4) specialized containers (each housed inside the other) are used to encapsulate the actinide materials, while stored in the reactor fuel vault and while being

transferred between the argon glove box in the Alpha Laboratory and the fuel vault.

46 The inner storage transfer container is a 20 ml scintillation vial, with a threaded cap. The vial is made of glass and the cap of hard molded plastic with a soft seal liner.

47 The second container is a 1-1/2 in. O.D. X 1-3/8 in. x 2-1/2 in. long stainless steel tube with a 1/16 in. stainless steel bottom welded on one end and an "O" ring modified male "Swagelok" compression fitting at the other. The female compression fitting cap is threaded over the "O" ring section and securely tightened. Each container was tested to 50 psig with no leaks.

48 The third container is a 4.500 in. O.D. x 4.026 in. I.D. x 10 in. long aluminum container. A 1/4 in. thick aluminum bottom is welded on one end and a double "O" ring flange is inserted and bolted in place at the other end. A 30 in. Hg vacuum to 30 psig pressure gauge is mounted on the flange as is an argon fill valve. Each aluminum container is pressure tested to 50 psig with no leakage. The aluminum container will hold up to four of the stainless steel containers.

49 The transport container used for movement and storage of the materials outside the glove box is a five (5) gallon Department of Transportation (DOT) approved container with a lid that is filled with packing material to tightly secure the aluminum container.

50 Each of the different materials used in the TRUMP-S experiments (uranium, plutonium, neptunium and americium) is contained in a separate aluminum container with a pressure gauge. Each of the types of materials is transported to and from the alpha laboratories in a separate DOT containers. Only one type of actinide material is transferred to and from the Alpha Laboratory at a time. There may be one or more stainless steel containers (container 2 above) with scintillation vials (the first container) subdividing particular materials inside the aluminum and DOT transfer containers.

Transportation of the materials
<u>to (from) the Argon Glove Box in the Alpha Laboratory</u>

51 For transport from the Alpha Laboratory to the fuel vault, or vice versa, the material is encapsulated into the four successive devices, each inside the other. The following steps outline the flow path to encapsulate the material in the argon glove box as per TAM-22 before transfer to the vault as per TAM-21. This series of steps is reversed to transfer material from the fuel vault and is governed by the same series of procedures.

All handling of each actinide material itself is only performed in the argon glove box.

52 Each piece of actinide material is either placed in total (or subdivided into parts) into one or more 20 ml scintillation vials with screw top lid and securely tightened. The material is now inside a purified high quality argon atmosphere.

53 The 20 ml vial is then placed into the stainless "O" ring sealed container and securely tightened. It too contains a purified high quality argon atmosphere.

54 Up to four (4) stainless steel containers may be placed in the 3rd "O" ring flanged aluminum container. The lid is bolted and tightened in place. A hand pump is connected to the argon valve on the container, and the container is pressurized to greater than 25 psig. The valve is closed and pump removed. The double encapsulated actinide material is now housed in a third pressurized container of high purity argon. The over pressure is monitored until the pressure is verified stable.

55 The aluminum container with the actinide material is then transferred from the argon glove box to the air glove box as per TAM-12.

56 The aluminum container with the actinide material is then transferred out of the air glove box by the "bag out" procedure TAM-14 "Bagging Material in and out of a Glove Box". Bag out (in) is a procedure for transferring items between the air glove box and the Alpha Laboratory. This procedure allows items to be transferred without opening the glove box.

57 The bagged out container is wrapped in a second piece of plastic, and then placed with sufficient packing in the 5 gallon DOT transport container and the lid is secured by a clamp compression seal ring.

58 The DOT transport container is then moved to the fuel vault as required by TAM-21. While the materials are in transit and during their storage in the reactor fuel vault, the materials are contained in three separate containers each with its own high purity argon blanket. These containers (which are stacked inside of each other) remain in the DOT transport container.

59 The SNM custodian completes the TRUMP-S Material transfer forms, and logs all material movement in the TRUMP-S Radioactive Material log book. The SNM custodian conducts at least monthly an inventory of all actinide materials as per TAM-23. The SNM custodian reads and records the pressure readings on each storage container. The Reactor Manager and the Principle Investigator and/or his staff are verbally notified of any discrepancies. A

written report, including any discrepancies, is submitted to the Reactor Manager.

60 Removal of the materials to the argon glove box merely reverses these steps. A DOT transfer container is placed in the Alpha Laboratory. The outer plastic bag is removed from the aluminum container. Then, the container, inside one plastic bag, is placed into the air glove box by the bag in technique described in TAM-14. The plastic wrapping and bagging material are removed inside the air glove box. The aluminum container is then passed into the connecting antechamber and to the argon glove box as per TAM-12. The succession of the aluminum container, stainless steel containers and then scintillation vial are opened when they are under the high purity argon blanket inside the argon glove box. The experimenters may then gain access to the materials.

Storage of Archived Materials

61 Once the actinide materials have been utilized in the TRUMP-S experiments, they are considered "archived material." These materials and other laboratory equipment which come in contact with the materials during the TRUMP-S experiments (such as the tantalum tubes) are stored in two successive "archived storage containers" inside the "archived storage vault."

62 The archived storage vault consists of a lead shielded drawer that is housed in a carbon steel lined and reinforced 12 in. thick concrete cavity recessed in the east wall of area 111, adjacent to the Alpha Laboratory, Room 111A. The cavity is 55 in. deep and extends approximately 5 in. beyond the face of the archived storage vault when the drawer is fully inserted. There are alignment rollers that guide the movement of the drawer and built-in mechanical stops that prevent the drawer from being inadvertently withdrawn out of the recessed cavity.

63 The recessed storage cavity is surrounded by earth on all sides except the west face. A minimum of 14 feet of earth is between the top of the storage cavity and the 8 in. grade level concrete floor.

64 The drawer is a carbon steel welded box mounted on casters with a storage capacity of 10 inches x 10 inches x 47 inches for a total volume of 4700 in^3 (2.72 ft^3). The moveable archived storage vault outer face is covered with lead shielding 2 inches thick on the exterior surfaces of the box. The drawer box is centered on the lead face which extends approximately 4 in. beyond all sides. Additional lead can be added inside the drawer as needed.

65 The archived storage vault is secured in position with an anchored padlocked chain with the keys under the control of the Manager of Health Physics. The SNM Custodian places a security seal on the locked drawer for material controls.

The Archived Storage Container

66 The archive sample storage containers consist of two separate containers one housed inside of the other.

67 The inner storage container is a stainless steel bolted 3/4 in. thick aluminum flange at one end with double "O" ring seal, 19 1/2 in. long, 2.375 in. O.D. x 2.067 in. I.D. pipe. A 1/4 in. thick aluminum plate is welded in the bottom. This inner container has been pressure tested with no leakage at 50 PSIG.

68 The outer storage container is a sealed 21 1/4 in. long 2.875 in. O.D. x 2.469 in. I.D. aluminum pipe with a stainless steel bolted 3/4 in. thick aluminum double "O" ring seal flange lid at the top and a 1/4 in. thick aluminum plate welded into the bottom. Attached to the side of the container is a valve isolatable 30 inch Hg vacuum to 30 PSIG pressure gauge and an argon fill isolation valve. The outer container has been pressure tested with no leakage at 50 PSIG.

Transportation of the Archived Containers and the Actinide Salts and Materials contained Therein

69 For transport from the Alpha Laboratory and the archived storage vault or vice versa, the archived samples are encapsulated into two successive devices, one inside the other. The following steps outline the flow path to transfer material from the argon glove box to the archived storage vault. This series of steps is a reverse to transfer archived samples from the archived storage vault to the argon glove box.

70 Empty containers for archived samples are transferred into argon glove box via the antechamber as per TAM-12. With the empty containers in the argon glove box, archived samples are loaded into the inner container, the lid attached and properly tightened (the inner container now contains a purified argon environment). The inner chamber is loaded into the outer container, the lid attached and properly tightened.

71 A hand operated pump is attached to the outer container fill valve and the valve opened. Argon is pumped from the Argon glove box environment into the outer chamber to an over pressure of at least 25 PSIG, the valve closed and the pump disconnected from the container.

72 The outer archive storage container, which is now filled with argon, is observed for a period of time to verify it is maintaining the desired pressure. Monitoring the outer container pressure verifies both the inner and outer container seal integrity.

73 The Archive storage container is then transferred from the argon glove box to the air glove box via the antechamber as per TAM-12. Archive samples are bagged out of the air glove box as per TAM-14.

74 The archive storage container is placed in a second plastic bag.

75 Under direction of the SNM Custodian and a Health Physicists, the archived samples are hand carried out of the Alpha Laboratory room 111A to the archived storage vault area just outside the lab in room 111.

76 The archived samples are placed into the designated archived storage vault by the nuclear custodian, closed, chained and locked. The SNM Custodian conducts at least monthly an inventory of all archived samples as per TAM-23. The SNM Custodian reads and records the pressure readings on each storage container. The Reactor Manager and the Principle Investigator and/or his staff are verbally notified of any discrepancies. A written report including any discrepancies is submitted to the Reactor Manager.

77 These steps are reversed in order to retrieve archived samples from the archived storage vault and to bring the archive storage containers into the argon glove box. Removal of the archived samples to the argon glove box merely reverses these steps. The archived sample container is removed from the archived storage vault and transferred to the Alpha Laboratory. The plastic wrapped aluminum container is placed into the air glove box through the bag in procedure as per TAM-14. The plastic wrappings are removed inside the air glove box. The aluminum container is passed into the antechamber to the argon glove box as per TAM-12. The succession of the aluminum containers are opened when they are under the high purity argon atmosphere inside the argon glove box. The experimenters may then gain access to the archived sample material.

78 In light of all the features discussed above, there are no credible accidents that place the actinide materials in transit or in storage at risk of fire or explosion.

Summary

79 The equipment in the Alpha Laboratory has been adequately inspected and tested.

80 Both the Alpha Laboratory and the general basement area adjacent to that Laboratory are constructed to minimize the spread of a fire. There are few combustibles in the Alpha Laboratory. The Alpha Laboratory ventilation system may also be isolated to limit oxygen to the fire and thus assist in containing the fire. The materials in the general basement area are controlled and do not represent a fire hazard to the Alpha Laboratory.

Subscribed and sworn
before me in
Boone County,
Missouri this 13th day of
November 1990

Sharon Wesselman
Notary Public
Sharon Wesselman, Notary Public, State of Missouri
My commission expires February 21, 1991
Boone County, Missouri
My Commission Expires

2-21-91

Chester B. Edwards Jr.
Chester B. Edwards Jr.
MURR Facilities Manager

LICENSEE'S EXHIBIT 4

ATTACHMENT 1

CHESTER B. EDWARDS JR.

PERSONAL AND PROFESSIONAL RESUME

Home: 1215 Nifong Boulevard
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Research Reactor Facility
Columbia, MO 65211
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Education

University of Missouri-Columbia, BS, Education (Industrial Arts), 1975, specializing in electricity-electronics, drafting, metals, machine shop, woodworking, general shop

DeVry Technical Institute, Chicago, Illinois, Associate in Applied Science in Electronic Technology degree, two year technical school in electronics, June 1962

Employment Experience

University of Missouri-Columbia, Research Reactor Facility (MURR), January 15, 1968 to Present

Positions: Facilities Manager, March 1989 to Present
Reactor Maintenance Engineer, January 1976 to March 1989
Senior Reactor Operator, January 1968 - January 1976 (Senior Reactor Operator License SOP-1123, issued by Nuclear Regulatory Commission)

Experience and Responsibility as Facilities Manager/Reactor Maintenance Engineer

Responsible for the Staff Engineers, Electronics Shop, Machine Shop and Drafting Service to provide the technical, engineering and shop support to maintain the reactor and assist in research and service activities. This includes designing, developing bid specifications, purchasing material and equipment, construction, installation, modification, repairs, and preventive maintenance on equipment throughout the facility. Our scheduled operation at full power is 150 hours per week, year round. Last year we achieved 102 percent of our operating schedule.

Upgrade team member promoting the MURR Reactor power upgrade, reactor instrumentation replacement, design for construction of a 44,000 square foot guide hall, laboratories and office space; addition of a cold source with guide tubes. Worked closely with the staff of our consultant, Stone and Webster Engineering Corporation, and vendors of cold sources, guide tubes and reactor instrumentation systems. Represented MURR in selection of architecture engineering firm of Servdrup Corporation to complete the facility design and construction bid documents. Participate in all the UM Facilities Management planning and strategy sessions.

Coordinate the University Physical Plant trades for general maintenance and modifications of the building, plus reactor requested alterations, installations and construction.

Reactor facility liaison and coordinator for contract project working with consulting firms detailing design considerations and developing bid document specifications. Coordinate and schedule the construction projects with general contractors and University Inspector.

Draft and approve Standard Operating Procedures (SOP) preventative maintenance procedures, modification records, maintain a 2000+ technical catalog file and an 1800+ drafting print file.

Employment Experience (cont'd):

Monitor and order spare parts for the spare parts inventory system.

Supervise, monitor, coordinate and participate in the following:

- Engineering Equipment Design
- Campus Facilities (UMC)
  - Construction Trades
  - Satellite, Maintenance Crews
    - Building Maintenance
  - Janitorial Support
  - Fire Protection
  - Engineering Services

- Facilities Management (UMC)
  - Facility Construction Projects
- Procurement of Reactor and Service Equipment
- Elevator Maintenance - Otis Elevator
- Science Instrument Shop - Machine shop
  - --five man shop used extensively
- Mechanical Engineering Machine Shop
- MURR Energy Coordinator
- MURR Telephone System Coordinator
- MURR Building Coordinator
- Prepare State Legislative Appropriation
  - Budget Requests for:
    - Preservation
    - Capital Equipment
    - Life Line and Safety
    - Energy
    - Minor Renovations
    - Capital Improvements
- Procurement of Surplus Property
- Columbia Fire Department
  - Training and Equipment Tests
- Robotics Development

As an administrative supervisor, my staff is made up of 9 full-time and four part-time student employees with the shop supervisors reporting directly to me:

Staff Engineers	2 Mechanical Engineers
Machine Shop	4 Machinists - Welders
Electronics Shop	2 Electronics Technicians
Drafting	1 Senior Draftsman
Undergraduate Students	4

Responsibility as Senior Reactor Operator

As a SRO I was part of the operating staff which manipulates the controls and operates the reactor, providing it as a tool for the research and service work. While working as a SRO, I completed my undergraduate education which qualified me for the promotion to Reactor Maintenance Engineer.

Regulations: Nuclear Regulatory Commission

We have considerable interactions with regulatory agencies and deal with the Code of Federal Regulations for all phases of our operation.

Papers

"Exhaust ventilation upgrade at MURR," C.B. Edwards, J.C. McKibben and C.B. McCracken, will be presented at the Reactor Operations Experience meeting of ANS, August 9, 1989

"Waste Heat Utilization at University of Missouri Research Reactor," C.B. Edwards and D.M. Alger, presented at the American Nuclear Society meeting, June 1980

"University of Missouri Research Reactor Can Melter System," C.B. Edwards, O.L. Olson, R.W. Stevens, R.M. Brugger, April 30, 1987, DOE grant report

Certificate of Appreciation

Awarded a Certificate of Appreciation, "In recognition of exceptional service in the support of research mission of the University during employment at the Research Reactor Facility," December 3, 1980 by Dr. Thomas Collins, Associate Vice-President of Academic Affairs, UMCa.

Argonne National Laboratory, July 1962 - January 1968, 9700 South Cass Avenue, Argonne, Illinois

Position: Senior Reactor Operator, qualified on two reactors

CP-5	5 MW Research Reactor
Janus	200 KW Research Reactor, 3 years
E.B.W.R.	70 MW Experimental Boiling Water Reactor