DL-010688_01

THE APPLIED RADIANT ENERGY CORP.

2432 LAKESIDE DRIVE
LYNCHBURG, VIRGINIA 24501
(804) 525-5252

January 6, 1988

United States Nuclear Regulatory Commission
Region II
Material Radiation Protection Section
101 Marietta St., N.W.
Atlanta, GA 30323

Dear Sirs:

Enclosed find the Applied Radiant Energy Corporation's application for renewal of our Material License #45-11496-01. Also enclosed is a check for $170 to cover the renewal fee.

This license was amended in entirety on July 10, 1986 in accordance with applications dated June 29, 1982 and September 5, 1985. Supporting information was provided in letters to the NRC dated April 11, and April 28, 1986. In making this application where information was deemed to require updating or emphasis, it has been provided following the guidelines of Draft Regulatory Guide FC-403-4.

We trust that the information currently supplied, and that contained in the referenced communications, is sufficient to allow prompt renewal of our Materials License.

If you have any questions, please contact James Myron at (804) 239-4300.

Sincerely,

APPLIED RADIANT ENERGY CORP.

Lawrence G. Barrett

Lawrence G. Barrett
President

LGB:deo

Enclosures
1. Application with supporting information (in duplicate)
2. Check $170

License Fee Information
on Application

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Appendices

Illustrations

NRC FORM 313
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10 CFR [illegible]
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U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires 4-30-92

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS: IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
631 PARK AVENUE
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCLEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

1. THIS IS AN APPLICATION FOR (Check appropriate item):

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 45-11496-01

2. NAME AND MAILING ADDRESS OF APPLICANT (Include Zip Code)

Applied Radiant Energy Corporation
2432 Lakeside Drive
Lynchburg, VA 24501

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED:

2432 Lakeside Drive
Lynchburg, VA 24501

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

James J. Myron

TELEPHONE NUMBER: (804) 239-4300

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL a. Element and mass number; b. chemical and physical form; and maximum amount which will be possessed at any one time	6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED
7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE	8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS
9. FACILITIES AND EQUIPMENT	10. RADIATION SAFETY PROGRAM
11. WASTE MANAGEMENT	12. LICENSE FEES (See 10 CFR 170 and Section 170.31) FEE CATEGORY: 3E AMOUNT ENCLOSED: $ 170.00

13. CERTIFICATION (Must be completed by applicant). THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT NAMED IN ITEM 2 CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001, ACT OF JUNE 25, 1948, 62 STAT. 749, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

SIGNATURE - CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
Lawrence G. Barrett	Lawrence G. Barrett	President	1/21/88

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS	APPROVED BY
Ren	Feb 2	3E		
AMOUNT RECEIVED	CHECK NUMBER			DATE
$170	[illegible]			

SUPPORTING INFORMATION FOR

ITEMS 5-11 OF

FORM 313

PGS. 1-8

ITEMS 5 - 11

Item #5 - Radioactive Material: This information is accurately stated in Items 6, 7 and 8 of our current Materials License (45-11496-01), as amended July 10, 1986.

Item #6 - Purposes for which Licensed Material will be Used: This information is accurately stated in Item 9 and Condition 17 of our current license.

Item #7 - Individuals Responsible for Radiation Safety Program and Their Training and Experience: The current license lists three Radiation Protection Officers; Lawrence G. Barrett, James J. Myron, and Rodney W. Bell. Their qualifications have been updated and enclosed.[1]

Item #8 - Training for Individuals Working In or Frequenting Restricted Areas:
NOTE: The only restricted area at ARECO is the space directly above the irradiator pool.
ARECO's license Condition #11 states that, "Licensed material shall be used by, or under the supervision of Lawrence G. Barrett, James J. Myron, Rodney W. Bell, or by individuals who have been trained as specified in application dated April 11, 1986. The licensee shall maintain records of individuals designated as users."

A copy of the April 11, 1986 correspondence in which the training program is outlined is enclosed;[2] the situation and conditions described are current with two (2) exceptions:

1) The first and second paragraphs of the letter refer to Condition #13. This is now Condition #11 of our amended license (July 10, 1986) and this condition has been amended as of April 9, 1987 to reflect some name changes.

2) The conditions of the training program are current except for the statement on page 2, section 2, last sentence. The waiting period to undergo training has been changed to 30 days. This change and the reasons for it were communicated by phone to Mr. Earl Wright, Senior License Reviewer at the NRC Region II office in Atlanta, GA on October 8, 1987.

A sample examination with answers has been supplied with the April 11, 1986 communication.

On-the-job-training is given by the most experienced and knowledgeable radiation technicians on an on-going basis. However, a more structured hands-on training, complete with written tests and examinations, is administered by Mr. Rodney W. Bell (a Radiation Protection Officer listed in Item #7).

The classroom instructor on the topics outlined in the April 11, 1986 letter is James J. Myron, Ph.D., who is also a Radiation Protection Officer.

All records documenting such training will be maintained for a minimum period of three (3) years.

1. See Appendix "A"
2. See Appendix "B"

ITEMS 5 - 11 (con't)

Item #9 - Facilities and Equipment: Information on this item is contained in previous written communications to the NRC; especially letters of information to the NRC of April 18, 1986, January 31, 1983, and June 29, 1982.

However, none of these documents is 100 percent accurate due to the significant amendment of July 10, 1986 and some subsequent alterations. Therefore, we felt it would be best to provide information on Item #9 following the Guide for the Preparation of Applications for Licenses. However, much of the information supplied is excerpted from these documents as much of the contents of these documents is still valid.

Our irradiators, licensed under #45-11496-01 and amendments thereto, are pool-type irradiators where the Cobalt-60 and Cesium-137 sources are always kept fully submerged under water to a depth where full biological radiation protection is provided to operating personnel and the public at all times.

We recognize that the standard approach to safety review and licensing of irradiators tends to treat them more generally as cell-type irradiators especially in view of the preponderance of this type.

We respectfully request that in reviewing our application for renewal, you re-establish in your mind the basic concept of our irradiators in order that you may more readily accept our limited response to questions raised which have their origins stemming from cell-type irradiator concepts.

9.1) Basic Facility Design and Construction:

1] Scales are given on drawings.

General description of facility at which the irradiators are located:

A map of Lynchburg is enclosed[3] upon which is marked the location of the irradiator facility near the intersection of U.S. Route 221 (Lakeside Drive) and State Route 291 (Old Forest Road). A site plan and a floor plan of the building are also enclosed (ARECO drawing A-1)[4]. The site plan shows the building's location with respect to Route 291. There are no intervening buildings or permanent structures.

The only "restricted area", as defined in 10 CFR, Part 20, Section 3, Paragraph 14, in the facility is the circular irradiator pool itself, which is identified on both the floor and site plans of drawing A-1.

The function of each area of the floor plan is given on the drawing and, except for minor modifications, is current. However, the floor plan of our irradiator building is subject to change as material irradiation requirements may develop. For example, it is anticipated that there will be a future need for additional access locations to the irradiator room for the transport of materials. These will be designed to restrict unauthorized personnel access. In addition, the relative positioning of various items used in the pool circulation equipment is also subject to change. When such changes have been made, updated drawings will be provided for record purposes.

3. See Illustration "A"
4. See Illustration "B"

1] (con't.) Irradiator Building: The irradiators are housed in one building of cinder block walls and steel roof decking construction.

2] Shielding: As indicated above, the irradiator pool is essentially below grade. Shielding is therefore provided by the depth of water over the radioactive sources, the concrete pool walls and the surrounding earth exterior to the pool walls. The pool consists of purified demineralized clear water of such depth that radiation levels at the pool surface are such that worker exposure will not exceed limits imposed by 10 CFR, Part 20.

3] Access to the Irradiation Room: The two accesses to the pool irradiator room are shown on the Floor Plan drawing. As stated in the January 31, 1983 correspondence, during the irradiators' operation, qualified personnel are always present at the facility either in the irradiation area or areas adjacent to it. All personnel are made aware of the necessity of preventing unauthorized personnel from entering areas other than the front office area. The door in the irradiator room to the west of the pool leads to a storage area and serves as an alternate exit in case of emergency. It is normally locked from the pool room side.

Control Devices, Alarms and Signals: Due to the pool containment design of the irradiators, conventional "control" devices are not necessary. Visual and audible alarms that would be activated by higher than normal radiation levels are located as follows. A NMC model GA-2A Gamma Alarm is mounted on the north wall approximately eight (8) feet from ground level and its visual alarm can be plainly seen from a distance of 20 feet from the one authorized entrance to the pool room. The audible alarm can be heard throughout the entire building. In addition, an Eberline SRM-100 Smart Radiation Monitor is mounted at a height of six (6) feet on the west wall of the pool room. Its alarms have been modified in such a manner that its visual alarm is also visible to people outside the pool room, but with a field of vision into the area. Its audio alarm has also been altered so that it is easily detectable throughout the entire building.

4] Area Adjacent to the Irradiation Room: These areas are diverse in nature and include outside, storage, laboratory, and working areas.

As the pool room itself has essentially normal background radiation levels and is not a restricted area except for the space directly above the pool, no restriction of movement is necessary in these adjacent areas.

5] Safety Systems: Essentially, the main safety system for the source material (Cobalt-60 and Cesium-137) is the maintenance of a sufficient depth of water over it to provide adequate shielding. Thus, the purpose of the regulatory requirements of each subitem in paragraph 20.203 (c) (6) of 10 CFR, Part 20 is met.

It should be noted that during over 20 years operation no "overexposure" incidents have occurred at the facility. This is the result of implementing the ALARA concept so that radiation levels to which personnel are exposed are normally background levels.

The continuous radiation monitoring instruments with alarms mentioned above provide warning if radiation levels in the pool room are above normal. Speedy exit from the irradiation room is always possible.

9.2) Other Safety Considerations:

1] Water Storage (and Operating) Pool:

a) The pool measures nine (9) feet inside diameter and is approximately 22 feet deep. The water is circulated by one inlet and one outlet line through which it is pumped through cation, anion, and mixed ion exchange resin beds and through a diatomaceous earth filter. A conductance meter measures the conductivity of the water before and after ion-exchange treatment. Normal observation of pool water clarity is used to determine the efficiency of the diatomaceous earth filtering process.

Pool dimensions

Water conductivity, pH, temperature, and flow rate through the ion exchange beds are recorded on a daily basis.

Normal make-up water is supplied through a demineralizer at a rate of three (3) gallons per minute. Water can be supplied under emergency conditions at a rate exceeding 100 gallons per minute from a nearby fire hydrant.

b) A leakage test was performed during March, 1986, where the pool was filled to a level within the normal operating range and the level noted. The identification numbers of each canister located within the pool at the time of start of the test was also noted. No make-up water was added over a period of four (4) days. A record was made of the number of canisters removed from the pool during this period of time and an estimate made of amount of water removed with each canister. (A small amount clings to surface and fills recesses of canister.)

Allowance was made for water lost on canister removals and also losses due to evaporation from pool surface. The pool geometry with the starting canisters was then duplicated at the end of the test period.

The water loss was determined to be less than five (5) gallons a day which is within the experimental error imposed by the method employed.

No Tot loss Normal OPN. 5 gal/day

Principals of Master Engineers and Designers PC (registered in the State of Virginia) were responsible for the design and installation of the irradiator pool. One of the engineers, Mr. C. M. Parker, has made a thorough inspection of the pool and has provided a report on the pool structure. A copy of the report is attached.[5] This report of April 11, 1986 was required to comply with a request for information from the NRC in a letter dated March 11, 1986. It concluded that the pool was water-tight at the time of inspection. In the interim a 1.21 megacurie Cesium-137 irradiator has been added in the pool. For a time the temperature rise, associated with the added radioactive material, caused considerable evaporative loss. Consequently, a water cooling system was installed in August, 1987. (This was reported by phone to Mr. Earl Wright, Senior License Reviewer, NRC, Region II on August 31, 1987.) Since its installation, make-up water addition rate has been the same as before the Master Engineers and Designers' survey. It is therefore concluded that the integrity of the pool has not changed from the time of the investigation.

5. See Appendix "C"

It is to be noted that this water chiller is supplemental equipment and is used only when appropriate depending on the time of year, amount of heat generated by polymerization, etc.

c) Pool Components: The pool is constructed of steam cured reinforced concrete pipe and is made up of four pipe sections with seal joints. The entire pool is below grade in dry soil. More details are contained in the enclosed April 11, 1986 report of Master Engineers and Designers.

Other materials in the pool are aluminum and stainless steel.

d) Automatic Water Replenishment: During normal operation of our irradiator pool, it is highly undesirable to automatically replenish water lost from the pool. This comes from the fact that the number of irradiation canisters currently varies from zero to four. Each of these displaces a volume of approximately 35 cubic feet. The insertion and removal of these canister cans, thus, have an effect on pool water level of approximately 2.2 feet. When the water level is at its lowest level with no irradiation canisters in the pool, adequate shielding is fully provided by the remaining water to prevent radiation levels rising at the working areas above the pool in excess of that allowed by the regulations of 10 CFR, Part 20.

Manual make-up is made whenever losses due to evaporation requires it.

No metering device is used in our make-up water supply line to indicate and record major changes in replenishment water requirements. Such a device is only needed with the use of an automatic water replenishment supply to the pool. With an automatic system one could have a fairly large leak in the pool and the automatic system would continue to keep the level up. No knowledge would be had of the leak unless a recorder were kept in operation showing consumption of water through the automatic make-up system.

e) Water Purity: [See section 1) a) of Item 9.2] Regeneration of the cation and anion beds is performed before the water conductivity approaches 6.0 microsiemans (micromhos) per centimeter.

f) Continuous Radiation Leak Detectors: Two systems are utilized. Their functioning is based upon the accumulation of radioactive material in a demineralizer bed with water flowing through it at a known rate. Radioactive ions dispersed in the pool at relatively low concentrations will be concentrated in the demineralizer bed.

An Eberline HP-270 probe connected to an Eberline Smart Radiation Monitor is placed in continuous contact with the outside surface of the cation ion exchange bed at a level where the circulating water first contacts the exchange resin. The alarm is set at a level slightly above that which would register an alarm from high background level bursts of radiation. As the water flows through the exchange bed at three (3) gallons per minute, very low levels of dissolved Cesium-137 chloride or Cobalt-60 salts in the pool water would set off this continuous monitor alarm.

The second system uses the continuous radiation monitor (NMC Gamma Alarm) as required under our present license. The detector of this device also monitors (in addition to the working area) the level of radioactivity present in the demineralizer. Both systems have audio and visual alarms.

Particulate Cobalt-60 would be trapped in the diatomaceous earth filter and would be detected by the weekly radiation survey of the pool room. All ion exchange and filter beds are specifically checked during this survey.

g) Pool Bottom Penetration: Four stainless steel wells (storage tubes) with water seals extend through the pool floor into the earth to a depth of approximately 13 feet below the surface of the pool bottom. These tubes are of welded construction and are embedded in the concrete floor. Their purpose is the temporary storage of Cobalt-60 rods should such a need arise. They have been present in the pool floor since its construction over 20 years ago and have not caused any safety or environmental problems throughout their time of existence.

h) Water Migration to Municipal Water: The location of the facility is such that any discharge of pool water has no chance of joining with any existing water supply system.

9.2)
2] In Air Irradiations: None are performed.

9.2)
3] Heat and Smoke-Sensing Devices: Such devices have been placed in the pool irradiator room and other appropriate locations in the facility. As previously noted, all source material is shielded at all times.

9.2)
4] Automatic Fire Extinguishing System: Due to the design of the irradiators and their mode of operation, such a system is not deemed to be necessary.

9.2)
5] Source Interference: Target material - source interference is prevented, again, as a result of the irradiator design and mode of operation.

Samples to be irradiated are placed in various shaped canisters. These canisters are then rendered air- and water-tight, and subsequently leak tested. After appropriate testing and pre-irradiation preparation, the canister is moved close to the pool surface by an electric overhead hoist.

The canister is properly positioned over the pool surface away from the irradiator plaque. It is lowered slowly and vertically until it reaches the level of the radioactive source plaque.

Safety chains are used during the transition from support by the overhead hoist chain and the canister support cables which are attached to an overhead trolley system.

The source plaque is then moved to an "irradiation" position and the canister is moved horizontally in the pool adjacent to the plaque. Some 40,000 to 50,000 such canister transfers have been made safely over nearly 20 years.

Removal of canisters involves essentially the reverse operations.

All such sample canister manipulations are performed by trained technicians. These technicians have been taught to observe precautions that minimize canister contact with the pool walls and the irradiator plaques.

ITEMS 5 - 11 (con't)

Item #10 - Radiation Safety Program:

10.1) Personal Monitoring Equipment: All company employees who enter the pool room wear film dosimeters. These badges are supplied by R. S. Landauer, Jr. and Company of Glenwood, Illinois. They are changed and analyzed on a monthly basis. Landauer's designation for this type of badge is GI, and the minimum measurable quantity of radiation is 10 millirems.

10.2) Radiation Detection Instruments: ARECO has on hand at its irradiation facility a G-M survey meter capable of measuring up to 1 roentgen per hour.

The survey meter is calibrated so that the readings are ±20% of the actual values over the range of the instrument.

Certificates showing the results and date of the last calibration are kept on hand.

Calibration is carried out regularly as part of a radiation audit conducted by Health Physics Consultation at periods not exceeding 12 months. This company also calibrates after servicing if the accredited service company does not. Health Physics Consultation's NRC license number is 45-19958-01.

All calibration records are kept for a minimum of 2 years after each calibration is performed by Health Physics Consultation (or the original equipment supplier).

10.3) Leak-Testing: The leak testing system for our wet storage irradiators has been described under Item 9.2) 1) (1) "Continuous Radiation Leak Detectors."

There are many different approaches that could be used to identify and remove leaking sources in the irradiator pool. One such method involving the Cesium-137 source is described in the previously referenced letter of April 18, 1986. The method outlined refers to the Cesium-137 plaque assembly shown in the enclosed drawing.[6] Please note that this drawing is of a typical source plaque arrangement. We wish to be on record indicating that the drawing represents only one configuration available to us in the operation of this irradiator, and that the irradiator can be operated utilizing configurations significantly different from that presently depicted. However, this procedure may be modified as changes in the leak testing equipment (e.g., for increased sensitivity) are made. Such alterations will be made if and when they are deemed appropriate after careful consideration of safety and environmental factors.

10.4) Operating and Emergency Procedures: Copies of operating and emergency procedures are provided to all personnel engaged in the use of the irradiator(s). These procedures include instructions, re: Immediate evacuation when a radiation alarm sounds; notification of a Radiation Protection Officer (if one is not present); briefing of R. P. O. on conditions just prior to alarm activation; and the use of survey meters during approach to the irradiator area to take corrective action. Such corrective actions are described for various situations that would be expected to be possible causes for alarm activation.

6. See Illustration "C"

10.4) con't.

1] All personnel engaged in irradiator operations are ordered to wear their personal film badges while working around the irradiator. Radiation Protection Officers and senior technicians check on a non-scheduled, spontaneous basis to see that badges are being worn.

2] Irradiator start-up and shut-down in the case of our irradiators essentially means sinking or raising leak-tight containers into or out of the pool.

3] In addition to constant monitoring of the area, a weekly radiation survey is carried out. This survey, using an Eberline G. M. survey meter E-520 with HP-270 probe (or equivalent), surveys a number of designated areas in the pool room with emphasis on all ion-exchange beds and the diatomaceous earth filter.

4] The most likely emergencies that can occur with a category 3E irradiator differ from the more common designs. The great majority involve an insufficient depth of water between the radioactive isotopes and the working area around the pool. Actions or conditions that could cause such a situation to exist have been listed in the emergency procedures along with actions to be taken. Instructions include the provision that at least one Radiation Protection Officer be notified of the emergency.

5] Major associated irradiator operations; e.g., instrument calibrations, leak testing, etc., are carried out under the supervision of Radiation Protection Officers or Health Physics Consultation. Transfer of radioactive material from a supplier to the bottom of the irradiator pool is carried out by R. P. O.s assisted by senior radiation workers, all of whom follow a detailed set of instructions drawn up especially for each such transfer. Other ancillary operations such as regeneration of ion-exchange beds, and cleaning and changing of diatomaceous earth filters are carried out as per written S. O. P.s by qualified "designated users". These S. O. P.s contain the performance standards for these operations.

10.5) Hospital Arrangements: Such arrangements have been made with Lynchburg General-Marshall Lodge Hospital, which is located approximately five (5) miles from the irradiator facility. A copy of a letter of agreement to treat employees in the event of an accident or injury due to irradiator operation is enclosed? Verify new current -

Item #1 - Waste Management: Although no planned source disposal is anticipated in the foreseeable future, if disposal is necessary it will be in accordance with Paragraph 20.301 (a) of 10 CFR Part 20. Cesium-137 elements would be returned to the Rockwell Hanford facility. Cobalt-60 elements would be returned to Neutron Products, Inc. or Brookhaven National Laboratory (unless an alternate authorized recipient is designated by the NRC).

7. See Appendix "D"

APPENDIX "A"

QUALIFICATIONS FOR RADIATION PROTECTION OFFICERS

PGS. 9-14

EXPERIENCE AND EDUCATIONAL BACKGROUND FOR

LAWRENCE G. BARRETT

EDUCATION:

Trinity College - BS in Physics and Mathematics (with honors) - 1951.

Oak Ridge School of Reactor Technology - 1952.

EXPERIENCE SUMMARY:

1964 - Present: Applied Radiant Energy Corporation/American Novawood Corporation. Hold 17 patents in the field of process radiation applications and technology. Five patents have been applied for in the field of food irradiation and associatied technology.

Introduced first consumer products manufactured by radiation processing techniques. Acrylic/wood flooring sold and installed throughout the world.

Developed specialized radiation processes for bio-burden reduction on medical and hospital supplies.

First to enter commercial production of irradiated flour.

1957 - 1964: Babcock & Wilcox Company - Experimental Physicist/Facility Manager. Responsible for the planning, functional design and construction of the Lynchburg Pool Reactor and the Hot Exponential Facility.

Project and Technical Manager for design, construction and operation of the B & W test reactor. Initial criticality was on schedule and costs were within 3% of budget.

1953 - 1957: General Electric Company - KAPL - Reactor Physicist. Analytical studies of submarine reactor cores under steady-state and transient conditions; evaluation of analytical and operational results.

1952 - 1953: The Foxboro Company - Nuclear Engineer. Worked on various design problems arising from the use of radioactive sources in instrumentation and controls.

Ref: License #45-11496-01

Lawrence G. Barrett

Formal Training in Radiation Safety:

	Type of Training	Where Trained	Duration of Training	Date of Training
A.	Principles and practices of radiation protection	Oak Ridge School of Reactor Technology (ORSORT)	1 yr.	1951 - 1952
B.	Radioactivity measurement standarization and monitoring	"	"	"
C.	Mathematics and calculations basic to the use and measurement of radioactivity	"	"	"
D.	Biological effects of radiation	"	"	"

EXPERIENCE AND EDUCATIONAL BACKGROUND FOR

JAMES J. MYRON

James J. Myron - B.Sc. (Chemistry)
- Engineering Diploma, Ph.D. (Radiation Chemistry)

Myron received his Ph.D. in radiation chemistry from the University of Alberta, Edmonton, Alberta, Canada (1964). For 4½ years he engaged in research on the radiolysis of organic compounds using a medical Cobalt-60 Gamma ray unit, a research Cobalt-60 Gamma ray source (maze configuration protection) and an Atomic Energy of Canada Ltd. Gammacell unit. This work and associated courses involved radiation effects on chemical systems, principles and practice of radiation protection and mathematics and calculations pertaining to the use and measurement of radioactivity.

He then spent two years at Florida State University, Tallahassee, Florida (Post Doctoral position) continuing studies in the radiation effects on chemicals using the x-rays generated by a 1.5 Mev Van de Graaf accelerator (1964-1966).

Two more years were spent at the Oak Ridge National Laboratory at Oak Ridge, Tennessee, where he employed a Cobalt-60 Gamma source for radiation synthesis studies (1966-1968).

From 1968 - 1980 he was employed at Goodyear Tire and Rubber Company, Akron, Ohio, performing radiation research and was listed as a user on their AEC-NRC license #34-00508-04 for their 10,000 curie Cobalt-60 source. From 1975 - 1980 he also used a 0.5 Mev electron accelerator for material processing.

From August, 1980 to the present he has been employed at The Applied Radiant Energy Corporation as Director of Radiation and Technical Services and is responsible for acrylic/wood flooring production and radiation services using the company's Cobalt-60 source which under the present license can utilize 400,000 curies, and the company's Cesium-137 source which can utilize 1,250,000 curies.

He had the prime responsibility for the safe installation of approximately 1.2 million curies of Cesium-137 at the company's irradiation facility in November of 1986.

Ref: License #34-[illegible]

James J. Myron

Formal Training in Radiation Safety:

Type of Training	Where Trained	Duration of Training	Date of Training
A. Principles and practices of radiation protection	University of Alberta Edmonton Alberta, Canada	1 yr.	1962
B. Radioactivity measurement standarization and monitoring	"	"	"
C. Mathematics and calculations basic to the use and measurement of radioactivity	"	"	"
D. Biological effects of radiation	"	"	"

EXPERIENCE AND EDUCATIONAL BACKGROUND FOR

RODNEY WAYNE BELL

EDUCATION:

Received BS in Physics from Roanoke College in 1975.

Course work included Nuclear Physics and Experimental Physics covering such topics as atomic theory/decay structure and practical operations such as running a linear 150KV accelerator, a polonium beryllium activation source and radioactive survey techniques.

Studied in Masters Program in Physics at East Carolina University (completed 37 semester hours).

Course work included Advanced Thermodynamics, Reactor Engineering, Solid State Devices. Taught introductory labs on Radioactive Decay, Dosimetry and Monitoring to non-science majors.

WORK HISTORY:

1980 - Present: Applied Radiant Energy Corporation

In the initial year with the company I was given the responsibility of securing Cobalt-60 for our source. This involved analyzing source line scans, calculating decays, and installing the product purchased. Under the supervision of licensed users I mastered the techniques of manipulation, placement, and data record keeping necessary for the reloading of our source.

Since February 1981, I have been a user under the Applied Radiant Energy Corporation license and have done extensive dose mapping (with solid state devices) as well as having performed additional rod relocations for the source.

In addition, I have been active in the company's radiation safety program. Daily observations of the source are included in my area of responsibility in addition to pool conditions, water clarity and quality, filtration and deionizer systems operation, regenerations, and the electrical interlock safety system. I have participated in the weekly radiation survey as well as the semiannual source leak tests.

In preparation for the installation and start-up of the new Cs-137 source, I helped develop the protocol and implement the standard procedures used for the receipt of new source material.

Since my appointment as an alternate R.P.O. I have been instrumental in the selection and training of those personnel chosen as "designated users". My areas of concern entail specific hands-on activities regarding our irradiator, training company personnel in safe W.E.S.F. capsule transfer/loading techniques, and continually updating and monitering performances for irradiator operations.

To obtain first hand information on plaque construction and operations, I was involved in the design, installation, and testing of related hardware, as well as the loading of the elements and their [illegible]

Rodney W. Bell

Formal Training in Radiation Safety:

Type of Training	Where Trained	Duration of Training	Date of Training
A. Principles and practices of radiation protection	Roanoke College East Carolina University	4 yrs. 4 yrs.	1971 - 1975 1975 - 1979
B. Radioactivity measurement standardization and monitoring	"	"	"
C. Mathematics and calculations basic to the use and measurement of radioactivity	"	"	"
D. Biological effects of radiation	"	"	"

APPENDIX "B"

LETTER CONCERNING AND OUTLINE
OF IRRADIATOR TRAINING PROGRAM

PGS. 15-19