Form AEC-313
(2-73)
10 CFR 30

D STATES ATOMIC ENERGY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

Form approved
Budget Bureau No. 38-R0027

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application or an application for renewal of a license. Information contained in previous applications filed with the Commission with respect to Items 8 through 15 may be incorporated by reference provided *references are clear and specific.* Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail two copies to: U.S. Atomic Energy Commission, Washington, D.C., 20545, Attention: Materials Branch, Directorate of Licensing. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30, and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20, and the license fee provisions of Title 10, Code of Federal Regulations, Part 170. The license fee category should be stated in Item 16 and the appropriate fee enclosed. (See Note in Instruction Sheet).

1. (a) NAME AND STREET ADDRESS OF APPLICANT *(Institution, firm, hospital person, etc. Include ZIP Code and telephone number.)*

Lower Colorado Region
Water and Power Resources Service
U.S. Department of the Interior
P.O. Box 427
Boulder City, Nevada 89005

(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. *(If different from 1(a). Include ZIP Code.)*

Water and Power Resources Service
Storage Building
400 Railroad Avenue
Boulder City, Nevada 89005
(see Attachment No. 1 for listing and description of all storage areas)

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

Irrigation Management Services Branch
Division of Water and Land Operations

3. PREVIOUS LICENSE NUMBER(S). *(If this is an application for renewal of a license, please indicate and give number.)*

Renewal of License 27-16664-01
Due to expire October 31, 1980

4. INDIVIDUAL USER(S). *(Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.)*

Multiple Users
Attachment No. 2 listing
Supervisory Personnel

5. RADIATION PROTECTION OFFICER. *(Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in Items 8 and 9.)*

Arnold S. Dransfield
(see Attachement No. 3 for resume of training and experience)

6. (a) BYPRODUCT MATERIAL. *(Elements and mass number of each.)*	(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME *(If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.)*
Americium 241	One sealed source of Americium-Beryllium, 80 millicuries source contained in model 5806 depth moisture probe, manufactured by Nuclear-Chicago Corporation.
Americium 241	Twenty-four (24) sealed sources, each containing 50 millicuries of Americium-Beryllium in model 503 depth moisture probes, manufactured by Campbell Pacific Nuclear Corporation.

7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. *(If byproduct material is for human use, supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)*

The sealed source contained in the Nuclear-Chicago model 5806 depth moisture probe and in the twenty-four (24) sealed sources in the Campbell Pacific Nuclear Corporation model 503 depth moisture probe will be used for in place measurement of the soil moisture on irrigated fields in various locations in Southern California, Arizona, Southern Nevada and Southern Utah. Specific, intensive operations are concentrated in the Colorado River Indian Reservation, Poston, Arizona, and the Wellton-Mohawk Irrigation and Drainage District in Wellton, Arizona.

The sealed sources are stored in the instruments described by model number above.

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(Continued on reverse side)

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	See Attachment 4		Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments	See Attachment 4		Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity	See Attachment 4		Yes No	Yes No
d. Biological effects of radiation	See Attachment 4		Yes No	Yes No

9. EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience.)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Americium-Beryllium		(1) Radiation Safety Training Courses (2) On-the-job use of gauges, Lower Colorado Region, Water and Power Resources Service	5 years neutron	Soil Moisture Measurement

10. RADIATION DETECTION INSTRUMENTS (Use supplemental sheets if necessary.)

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr/hr)	WINDOW THICKNESS (mg/cm²)	USE (Monitoring, surveying, measuring)

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED (For film badges, specify method of calibrating and processing, or name of supplier.)

Combination nuetron, X-ray, Gamma and Beta Film Badge Service-Badges read monthly-by a reputable firm such as Searle Analytic, Inc., Des Plaines, Illinois 60018 or Radiation Detection Company, P.O. Box 1414, Sunnyvale, California 94088.

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No

No remote handling

14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.

See Attachment No. 5

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved. If disposal is required we will contact Campbell Pacific Nuclear Corporation and the NRC for disposal instructions.

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

License Fee Category $ ____________

Fee Enclosed $ ____________

____________ Applicant named in item 1

By: Regional Director

Date ____________ JUL 23 AM 11 02 RECEIVED

____________ Title of certifying official

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.

ATTACHMENT NO. 1

ATTACHMENT TO APPLICATION FOR BYPRODUCT MATERIAL LICENSE
FORM AEC-313

Item 1b - Street Address(es) at Which Byproduct Material Will be Used

None, one or all of the gauges may be stored in each of these four (4) communities, in the facilities described.

(1) Boulder City, Nevada 89005

The gauges are stored in a 20' x 15' locked storage room in a Water and Power Resources Service storage room at 400 Railroad Avenue. Personnel access to the area is limited.

(2) Poston, Arizona 85371

The gauges are stored in a metal storage cabinet inside a locked storage room in a concrete building at the "Hatch Center." The storage is located about 40 feet from an area which is used infrequently for office space.

(3) Wellton, Arizona 85356

The gauges are stored in a room which is kept locked in the Irrigation Management Services' (IMS) building inside the Wellton-Mohawk Irrigation and Drainage District compound. The storage room is 10 feet from a small office room which is occupied less than 1 hour each day and 20 to 25 feet from the main office area which is a regularly occupied work area.

(4) Yuma, Arizona 85364

The gauges are stored in the supply warehouse in a heavy metal storage chest which is locked when the gauges are in storage. It will be located in that part of the warehouse infrequently visited by warehousemen. The warehouse office which is occupied 8 to 10 hours each day is at least 30 feet from the storage site of the gauges.

(5) All of these gauges are transported to and from field locations daily during normal working conditions. They are in storage only during nonworking hours. Occasionally these gauges are used remote from their normal area of operations. When this situation occurs, storage will be their shipping "cases" which will be locked and placed in a secured area at least 10 feet away from human activity.

ATTACHMENT NO. 2

ATTACHMENT TO APPLICATION FOR BYPRODUCT MATERIAL LICENSE
FORM AEC-313

Item 4 (Individual Users)

The Irrigation Management Services (IMS) program utilizes the neutron probe to determine soil moisture status of irrigated fields. One trained person using one Model 503 neutron probe may service sites in as many as 150 fields twice each week. Since in each area there are hundreds of fields, 3 to 15 persons are employed in each area to accomplish the job. We experience a continual turnover in personnel at the field operations level.

These people work under radiation safety trained supervisors in each work area. The supervisors are responsible to see that each employee working with the neutron probe works safely and has received training in radiation safety from the Radiation Safety Training Officer through the 8-hour safety course included with this license application. The supervisor conducts "Tool Box" safety meetings as needed to assure a safety conscious work environment.

The following named individuals are supervisors at this time and supervise the field employees in their use of the byproduct material (sealed sources in depth moisture gauges).

Arnold S. Dransfield, Chief, Irrigation Management Services Branch, is the Radiation Safety Training Officer and Regional Radiation Safety Officer, Boulder City, Nevada.

Stanley Conway, Supervisory Soil Scientist, Yuma, Arizona, Supervisor of IMS program in the Yuma, Arizona, area.

Ralph Vaughn, IMS Supervising Technician, Wellton, Arizona.

ATTACHMENT NO. 3

ATTACHMENT TO APPLICATION FOR BYPRODUCT MATERIAL LICENSE
FORM AEC-313

Item 5 - Radiation Protection Officer and Radiation Safety Training Officer

-Resume of Training and Experience-

Outline of Radiation Training Course

General

Mr. Arnold S. Dransfield will be the Radiation Protection Officer and also the Radiation Safety Training Officer. He holds a Bachelor of Science Degree from the Utah State University granted in 1950. He has 33 years of Federal service. He is a trained Soil Scientist and holds the position of Regional Soil Scientist for the Water and Power Resources Service in the Lower Colorado Region. He works in the Division of Water and Land Operations where he is the Branch Chief in charge of the Irrigation Management Services (IMS) program. Since the use of the neutron probes is exclusively in his branch and under his area of responsibility, he was appointed Radiation Safety Officer by the Regional Director by letter dated February 19, 1976.

Technical

Mr. Dransfield successfully completed a 32-hour Radiation Safety Specialist Training Program and the 4-hour Comprehensive Examination conducted by Oklahoma State University in Oklahoma City, Oklahoma, in October 1-5, 1979. He has also completed three 8-hour technical training courses presented by Campbell Pacific Nuclear Corporation, Pacheco, California, in radiation safety and operation of depth and density gauges which have radiation sources of less than 100 millicuries. His on the job experience using these gauges has been continuous since 1975.

Radiation Safety Training Course - Designated Instructor

Mr. Dransfield is designated the Radiation Safety Training Officer for those persons engaged in Irrigation Management Services. The agenda of the safety training course for soil depth moisture gauge operators is outlined on Attachment No. 3A to this license renewal application.

ATTACHMENT NO. 3A
NUCLEAR SAFETY TRAINING COURSE
FOR SOIL DEPTH MOISTURE GAUGE OPERATORS
(NEUTRON PROBE - LESS THAN 100 MILLICURIES
AMERICIUM 241/BERYLLIUM)
LOWER COLORADO REGION
WATER AND POWER RESOURCES SERVICE
ARNOLD S. DRANSFIELD - NCR APPROVED TRAINING OFFICER

Educational Objectives:

1. This course is designed to permit the operator to safely use a nuclear soil testing gauge.

2. To accurately obtain the desired field results.

3. To qualify the operator to meet Nuclear Regulatory Commission and State licensing requirements upon completion of this course.

Instruction Time:

1. Eight hours:

Morning I. Principles of Nuclear Physics Relative to Soil Moisture measurements.

II. Health Safety - Radiation Exposure Potential

III. Regulation and Safety Procedures

Afternoon

IV. Field use of Nuclear gauges.

V. Statistical Evaluation of Results.

VI. Evaluation:

1. Written test at the end of the course.

2. Field demonstration of equipment use.

I. Principles of Nuclear Physics Relative to Soil Measurements

A. General
1. Definition of Radiation - Electromagnetic scale
a. Radio
b. Infrared
c. Light
d. Ultraviolet
e. X-Ray
f. Gamma Ray

2. Unstable elements - Naturally occuring and reactor produced.
   a. Radium - Naturally occuring
   b. Cesium 137 and Americium 241 - Reactor produced
   c. Cesium ½ life - 30 yrs. - Seven ½ lives - 10% left

3. Act of Decaying - Emissions
   a. Rays of electromagnetic scale - Gamma Rays
   b. Particles of material - Neutrons
   c. Other emissions
   d. Gamma and Neutron in soil moisture measure

4. Gamma Radiation
   a. Spontaneous from Cesium or Radium

5. Neutron Emission
   a. Occurs when alpha particle emitter (Americium, Plutonium, or Radium) is mixed with Beryllium powder in a tightly compressed pellet.
   b. Alpha particles strike Be atoms to produce fast neutrons of average energy 5MEV.

6. Detection
   a. Geiger Mueller Tubes - for Gamma
   b. Boron Tri-fluoride - BF3, or Helium - 3 H3 Tubes - For Neutron
   c. Resultant signals are displayed electronically as index of soil density and moisture.

7. Dissipation of Radiation
   a. Light Rays - diminish by inverse square law
   b. Penetrate certain materials
   c. Absorbed by certain materials

8. Radioactive Radiation - Obeys same rules (Inverse Square Law)
   a. Farther from source - safer we are
   b. More absorbing material shielding - safer we are
   c. Equipment design - optimum safety

B. Gamma Radiation

1. Electromagnetic photon energy
   a. Useful for total mass measurements
   b. Useful to determine soil density

2. Cesium 137 - a single energy level source
   a. Energy level is 0.66 MEV
   b. Requires less shielding than Radium
   c. Reactor produced isotope
   d. Requires license for use anywhere in U.S. and in foreign countries.

C. Neutron Emission

1. Building blocks of Atom
   a. Protons - positive charge
   b. Electrons - negative charge
   c. Neutrons - no charge

2. Fast Neutron Emmission
   a. 5.0 MEV of energy
   b. Detectors see only slow or thermal
   c. Fast neutrons must slow down to be counted

3. Collisions
   a. With nuclei of large atoms - Rebound with little loss of energy
   b. With orbiting electrons (1/1840th the weight of neutron) produces little loss of energy
   c. With object of same mass will produce major loss of energy (Remember marble games)

II. Health Safety - Radiation Exposure

A. Source Nomenclature

1. Currie
   a. Term used to describe size of source
   b. One Currie = quantity of material disintegrating at the rate of 3.7×10^{10} disintegrations per second - same rate as one gram of Radium
   c. Currie = index of quantity - not danger

2. Milicurrie
   a. 1/1000th of a Currie
   b. We deal in small quantities of radioactive materials

3. Roentgen
   a. Term describing amount of radiation accumulated - dose - exposure
   b. Roentgen of radiation can be accumulated by exposure to large, unshielded source for short time or to small, shielded source for long time.

4. REM - Roentgen Effect on Man
   a. Superior term for human exposure accumulation
   b. Corrected to provide common base for effects
   c. Some radiation - higher potential of danger than other - corrected, becomes equal - REM
   d. We deal in small amounts - Millirems - MREM

5. Milirem/Hour (MREM/HR)
   a. Brightness of radioactive gamma source
   b. Similar to foot candles of light
   c. Brightness is determined by:
      Type of source
      Size of source
      Amount of shielding
      Distance from source
   d. Total amount of radiation accumulated becomes a factor, also time we remain in field of exposure

6. Flux
   a. Describes strength of a neutron field
   b. Number of Neutrons per square centimeter

7. Dose Calculations
   a. Know the radiation level in which we are working and duration of exposure
   b. Multiply the MREM/HR value times duration of exposure
   c. Accepted level - edict of Nuclear Regulatory Commission - is 5.0 REM/YR - Appx. 100 MREM/Week

B. Portaprobe Calculations

1. Average Radiation Levels
   a. 2 ft. from Portaprobe is less than 0.5 MREM/HR
   b. Average level on surface = 5 MREM/HR

2. Whole body doses - Primary interest
   a. Extremities can absorb 15 times whole body allowance
   b. 2 ft. distance - working distance
   c. Normal operating procedures - approximately 10 seconds per test
   d. Normal day - 30 tests
      Testing 5 days per week, total radiation absorbed
      1) 10 sec. x 30 tests = 300 seconds/day
      2) 5 min/day x 5 days = 25 min/wk - appx. ½ hr.
      3) ½ hr x 0.5 MREM/HR = 0.25 MREM accumulation or 1/400 the allowed dose
   e. Follow prescribed operation - gauge is safe for intended use
   f. Don't set the gauge in your lap
   g. Don't attempt to repair the source in any way!

NEVER EXPOSE THE SOURCE UNNECESSARILY !! OR TOUCH IT !!

c. Soil Gauge Sources

1. Most Common
   a. Cesium 137 for gamma emission
   b. Americium 241/Be for neutron emission
   c. Radium 226/Be for combined gamma and neutron

2. Sealed Sources
   a. Sealed stainless steel capsule, doubly encapsulated and welded into the gauge housing.
   b. Source should never be removed from the mounting
   c. Advise the factory immediately in event of damage to a source.

III. Regulation and Safety Procedures

A. Licensing

1. Primary Licensing Agency
   a. Nuclear Regulatory Commission - has jurisdiction over reactor produced isotopes - but not Radium Has license authority over Federal agencies

2. State License
   a. 25 states - own licensing
   b. License Radium as well as X-Ray and other ionizing devices or materials

3. Essential that Operator read and understand the License Under which he proposes to use radioactive material.
   a. Must not vary from stipulated use of material
   b. License will require that one person be designated as Radiation Safety Officer.
   c. Transfer of Radioactive material to others --

B. Transportation

1. Yellow II Labeling
   a. Outside of container has less than 10 MREM/HR on any surface and less than 0.5 MREM/HR at 3 ft. from any surface
   b. No placarding of vehicle is required when devices are in shipping container
   c. When not in shipping container and transported on public roads, vehicle would require placard stating "Radioactive" in 4 in. high letters, front, back and sides of vehicle.
   d. Case should be locked

C. Storage

1. Location
   a. Permanent storage - 10 ft. from nearest point of full time work requirements.
   b. Post a permanent "Caution - Radioactive Material" sign on storage door.
   c. Recommend notification of fire department of nature of source material

2. Health Safety Considerations
   a. Protection of Operator
   b. Protection of General Public
   c. Protection of Equipment

3. Film Badges
   a. Most licenses require Operator to wear
   b. Record gamma absorption with excellent accuracy
   c. Neutron record fades within 30 days

D. Field Safety

1. Procedures
   a. Under control of licensed Operator
   b. Interested parties must receive proper training to use device.

E. Leak Testing

1. License Regulations
   a. All sealed sources be leak tested at designated time intervals
   b. Generally performed by the Radiation Safety Officer
   c. Know what frequency of testing your license requires
   d. Up to date leak test certificates must be maintained in the Radiation License File
   e. Must certify that less than 0.005 microcurries of removable contamination was removed from the gauge at its last test.

F. Records

1. Radiation Safety Officer Responsible

2. Recommend three ring notebook with tabbed sections
   a. License and supporting documentation
   b. Personnel records, training, etc.
   c. Film Badge Records
   d. Leak Test Records

3. Must be available to license inspection at all times

G. Emergencies

1. Vehicle Accident

   a. Prevent exposure to operator and others
   b. Insure radioactive materials do not escape the capsule

2. Gauge Damage
   a. Protect People
   b. Protect gauge from further damage
   c. Protect surrounding area from contamination - Freeze site if necessary
   d. Call for help from your R.S.O.

3. Play it safe
   a. Do not be unduly bold or brave
   b. Keep people out of the damage area until it is cleared by nuclear experts.

ATTACHMENT NO. 4

ATTACHMENT TO APPLICATION FOR BYPRODUCT MATERIAL LICENSE
FORM AEC-313

Item 8 - Training and Experience of Individuals Named in Item 4

Individuals Named in Item 4

Arnold S. Dransfield 1/, Stanley Conway, Ralph Vaughn

All individuals named in Item 4 (Form AEC-313) have attended at least two training sessions in safety and operation of the gauge through the State of California approved training course presented by Campbell Pacific Nuclear Corporation (CPN) of Pacheco, California.

Other Users

Several field users of the gauges may work under the day to day supervision of the individuals named in Item 4.

Prior to their working with the gauge these field users (individuals) are given the CPN Radiation Safety Manual to study. The material is then discussed between the individual and his immediate supervisor and a test over the material is administered. After testing, the questions on the test are discussed with the individual tested and his supervisor to assure his conceptual understanding. On the job training in operation, care and safety of the gauge is provided each employee before this gauge is released to him for routine use.

As soon as practicable the individual is enrolled in the Water and Power Resources Service offical 8-Hour Radiation Safety Training course outlined in Attachment No. 3.

Periodic "Tool Box" safety meetings are a regular part of our safety training program. Emphasis is placed on personal and public safety, safe vehicle operation and security of equipment.

1/ See Attachment No. 3 for additional type of training received by Arnold S. Dransfield.

ATTACHMENT NO. 5

ATTACHMENT TO APPLICATION FOR BYPRODUCT MATERIAL LICENSE
FORM AEC-313

Item 14 - Radiation Protection Program

All operators will be monitored monthly by individually assigned radiation detection film (XBGN) badges.

Leak testing of all equipment will be conducted by the Radiation Safety Officer at intervals not to exceed 12 months. Prescribed techniques suggested by the gauge manufacturer and the testing laboratory will be followed.

All repairs and service maintenance of the gauge other than electrical will be done by the manufacturer.

Transportation of the gauges will be in their own factory designed carrying cases which will be securely mounted in the back of a pickup truck or other suitable vehicle. The gauge carrying case will be clearly marked with radiation warning signs. Use and handling of the gauges will be in accordance with recommended safety instructions of the manufacturer and in accordance with applicable Nuclear Regulatory Commission directives.