#6.

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170.

Mr. Joseph M. Brown, Jr.
Radioisotopes Licensing Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Brown:

In accordance with the requirements set forth on page 4, item 4 - Personnel (a), (b), (c), of a document entitled, "A GUIDE FOR PREPARATION OF BY-PRODUCT MATERIAL APPLICATIONS FOR THE USE OF SEALED SOURCES IN PORTABLE AND SEMIPORTABLE GAUGING DEVICES", we are submitting the name of V. Keith Ebersole as USBR Radiation Safety Training Officer under materials license No. 11-16934-01.

Mr. Ebersole is a former school teacher with a B.S. degree in Physics, Idaho Secondary Certificate in Physical Science and Math, Master of Education degree with a major in Physics from University of Utah, total of 11 years teaching experience (3 years advanced Physics course). He has successfully completed the 8 hour Radiation Safety Course offered by Campbell Pacific Nuclear Corp., Pacheco, California and has somewhat less than a years experience in the field with the hydroprobe 503. Included is a complete resume of Mr. Ebersole's academic training and work experience.

Attached is a proposed outline of formal and on-the-job training to be provided. The outline defines the means of determining when the trainee has satisfactorily completed training and is capable of carrying out radiation safety responsibilities required by the license.

We also propose to amend item, "Condition 12", to read "the Radiation Safety Officer will review the training record prepared by the Radiation Training Officer and issue a user authorization to qualified operators." A current list of authorized users and the training records of each will be maintained in the files of the

Radiation Safety Officer at 550 W. Fort Street, Room 531, Boise, Idaho 83724.

Your prompt attention to these matters will be appreciated.

Sincerely,

Acting for Henry L. Green

Regional Director

Enclosures

M MCVAY:za 6/30/78

#6.

RESUME

V. Keith Ebersole
1910 Miller Avenue
Burley, Idaho

During World War II, I served in the Navy Air Corps as an Electronics Technician 1st Class after attending Naval schools for the necessary training in Physics, Mathematics, and Electronics.

I started back to school in 1962 by attending night classes at Idaho State University until 1967 earning 74 semester hours of credit.

In 1968 I matriculated with Northwest Nazarene College in Nampa, Idaho and earned the Bachelors degree in Physics and Education with a minor in Mathematics in 1970.

Upon receiving an Academic year award to the University of Utah during the summer of 1970, I entered that University in the fall to study for a Masters degree in Science Education. I graduated on June 1, 1971, with a Masters of Science Education as a member of Phi Kappa Phi honor society. My chief graduate college subjects were Physics, Geology, and Education.

My teaching experience began in the Navy where I instructed Navy Night Fighter pilots in the use and operation of the radar until I was discharged in 1945.

In 1960, I resumed teaching in the public schools in Rupert, Idaho, teaching Physics, and Mathematics prior to returning to college. After receiving

the Master degree, I returned to Nampa, Idaho, and taught Advanced Physics, Mathematics, and Earth Science under an Idaho Advanced Secondary Teaching Certificate until the spring of 1974, when I began a career with the Bureau of Reclamation.

My experience with the Campbell Pacific Hydro-probe has been during the summer of 1977 until the present. Other experience related to radioactive materials was radiation detection work for the civil defense at Jackson Lake Dam and Reservoir, Jackson, Wyoming.

Training Course
for Nuclear Equipment Operators

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.

Evaluation:

1. Written test at the end of the course.

2. Field demonstration.

Classroom Time:

1. Eight Hours:

Morning

a) Principles of Nuclear Physics for Soil Moisture measurements.

b) Health Safety Regulations and Emergency measures.

c) Application of Radiosotopes to Soil Gauge Design.

Afternoon

a) Field use of Nuclear gauges.

b) Statistical Evaluation of Results.

c) Quiz.

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 lifes - 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 - BF_3, or Helium - 3 H_3 Tubes
    c. Resultant signals are displayed electronicly 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
   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 Emission
   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)

D. 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. 1/1000 th of a Currie
   b. We deal in small quantities of radioactive

3. Roentgen
   a. Term describing amount of radiation accumulated - dose - exposure
   b. Roentgen of radiation can be acummulated 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 others - Corrected, becomes equal - REM
   d. We deal in small amounts - Milirems - MREM

5. Milirem/Hour (MREM/HR)
   a. Brightness of radioactive gamma source
   b. Similiar 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 NRC Commission - is 5.0 REM/YR - Appx. 100 MREM/Week

E. 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. ¼ hr.
3) ¼ 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 !!

F. 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 further welded into a stainless steel source rod or located permanetly in the gauge housing.
   b. Source should never be removed from the mounting
   c. Advise the factory immediately in event of damage to a source.

G. Licensing

1. Primary Licensing Agency
   a. Nuclear Regulatory Commission - has jurisdiction over reactor produced isotopes - but not Radium

2. State License
   a. 25 states - own licensing
   b. licence 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 --

H. 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

I. 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

J. Field Safety

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

K. Leak Testing

1. License Regulations
   a. All sealed sources be leak tested occasionally
   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.

L. 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

M. 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.