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College of Tropical Agriculture and Human Resources

Department of Food Science and Human Nutrition

1920 Edmondson Road • Honolulu, Hawaii 96822

Cable Address: UNIHAW

REGION V INF

July 19, 1985

Ms. Beth A Riedlinger
Health Physicist (Licensing)
Nuclear Materials Safety Section
U.S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596

Docket No. 030-07113
License No. 53-00017-09
Control No. 70205

Dear Ms. Riedlinger:

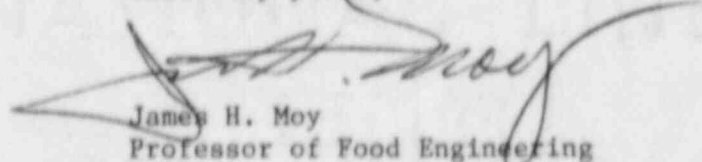
RE: Mail Control No. 70205

Thank you for your letter of June 28, 1985 regarding our license renewal application. In response to your comments, we have revised our documents as follows (Ref. Items 1, a, b, c, 2 and 3 in your letter):

1. a,b: Stated in Part 8 of the attachment to NRC Form 313: 2-hr for didactic training, 1-2 hrs for standard operating procedure and hands-on experience.
1. c: included in Part 8
2. Included in Part 9
3. Part 12 added

We hope these revisions will be satisfactory. Thank you.

Sincerely yours,


James H. Moy
Professor of Food Engineering

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REGS LIC30
53-00017-09 PDR

JHM:tn
Enc.

cc: Dr. C. T. K. Ching
Dr. Edison W. Putman

Application for Material License
NRC Form 313
(Attachment)

University of Hawaii
Honolulu, Hawaii
Rev. 7/19/85

5. Radioactive Material:

- a. Cobalt-60
- b. Sealed Sources (Brookhaven Natl Lab. MKI standard strip sources and/or sources as per BNL Drawing ME 188-135-3C).
- c. 45,000 curies total

6. Purposes:

To be used in a modified Brookhaven National Laboratory designed Mark IV research food irradiator to determine biological and chemical effects of gamma-radiation for purposes of food preservation, insect sterilization, mutant induction in plants, soil sterilization, cell response to gamma-radiation, and simulation of radiation effect in outer space.

7. Radiation Safety - Individual Responsible For:

James H. Moy, Professor of Food Engineering, U. of Hawaii

- B.S. & M.S. Chem. Engineering, U. of Wisconsin-Madison, 1957 & 1958. University courses in Radiation Chemistry; Transport Process, Nuclear Engineering; graduate courses in Kinetics and Catalysis. Material and Energy Balance, Advanced Thermodynamics, Advanced Fluid Mechanics.
- Ph.D. Food Science, Rutgers University-New Brunswick, 1965. Radiation Biology, and Radiation Preservation of Food (part of Food Preservation).
- Project Leader & P.I. Food Irrad. Proj. (AEC-sponsored), U. of Hawaii (AEC-sponsored) 1965-72.
- Dosimetry Workshop, U.S. Army Natick Lab., 5 days, 1968.
- Supervisor, Hawaii Research Irradiator (HRI) 1968-present
- Proj. P.I. Fruit Irrad. Proj. (State Calif-sponsored) 1980-83.

Edison W. Putman, Assoc. Professor of Plant Physiology, U. of Hawaii

- B.A. 1942, Ph.D. Plant Physiology, UC Berkeley, 1952
Course in Atomic Physics, Nuclear Chemistry, and Health Physics
- Asst. Res. Biochemist, U.C. Berkeley, 1952-59
Used ^{14}C , ^{32}P and ^{60}Co for research.
- Assoc. Professor Plant Physiology, U. of Hawaii 1959-present
Used ^{14}C , ^{32}P , ^{45}Ca , ^{35}S for research.
- Chairman, U. Haw. Radiological Activities Committee 1964-69.
- Co-Supervisor, HRI, 1978-present.
- Radiation Safety, UC-Berkeley, 1947.
Courses in Radiation Protection, Radiation Instrumentation,
Radiation Biology and Radiation Physics.

The University of Hawaii also has a Radiation Safety Office which would render assistance and guidance when needed. The Radiation Safety Officer is Thomas J. Bauer.

8. Training of operators:

As described under Administrative Procedures, p. 6-7 of the Standard Operational Procedure (SOP) of the Hawaii Research Irradiator (HRI).

A two-hour didactic training session will cover radiation sources, radiation chemistry, radiation health physics, and radiation safety. Another hands-on training session, about 1 to 2 hrs, will cover facility design, radiation monitoring and standard operating procedures. Each operator will operate the irradiator individually during that session in the presence of the supervisor, plus once more in his/her next signed-up use of the irradiator. This is considered adequate for subsequent, independent use of the irradiator by each authorized operator.

Training sessions have been scheduled about once a year depending on needs. Training records are on file in the facility for inspection purposes.

9. Facilities and Equipment:

The Hawaii Research Irradiator (HRI) is a Co-60 irradiator of the BNL Mark IV design completed in January, 1965 with an initial activity of 30,000 Ci. The 100 Co-60 strips are kept under 11 1/2 ft of deionized, refrigerated (58°F) water with 50 strips to a plaque.

The central chamber, measured 22 1/2" L x 7 1/4" W x 22" H, receives samples to be irradiated with a water-tight cover. Dose rates of the source are measured with the Fricke dosimetry procedure and are mapped according to the geometry of the chamber. 3 6" and 5x3" wet tubes are also available but they are seldom used.

The source has been upgraded twice since 1965. In July, 1968, it was upgraded to 19,500 Ci. In January, 1978, it was upgraded to 42,500 Ci. Each time an outside licensed radiation contractor performed the job. As of May 20, 1985, the source strength was 16,473 Ci by normal decay.

Besides the irradiator, equipment include: two monitor-detectors, one calibrated, portable survey meter capable of measuring up to 500 milliroentgen per hour, an ion-exchange system, a refrigeration system, water level alarm, conductivity meter, air-conditioner, exhaust fan, and audio-visual alarm outside the building.

10. Radiation Safety Program

As described in the Standard Operational Procedure (attached)

p. 1 Operational Hazards and Control

p. 2 Direct Radiation Control

p. 2-3 Contamination Control

p. 3 Emergency Action

p. 4 Facility Operation, Weekly Test

p. 8-9 Leak Test Procedure

11. Waste Management

There is no radioactive waste to be disposed of.

In 1968 and 1978, low activity strips were returned to ERDA & DOE receiving depots in Nevada and Washington.

12. Experimental Irradiated Food:

Irradiated food samples prepared for experimental study such as for conducting taste test will be distributed in accordance with FDA regulations.

STANDARD OPERATIONAL PROCEDURE

HAWAII RESEARCH IRRADIATOR, UNIVERSITY OF HAWAII
Amendment No. 1 to Supplemental Information, Licensing Requirement for
Gamma Irradiator for University of Hawaii. (Ref.: Item G).

Responsibility:

The irradiator may be used only with the assistance of an authorized facility operator upon approval by the Supervisors, Dr. James H. Moy, or Dr. Edison W. Putman.

Scheduling:

Scheduling the use of the irradiation facility should be made with Dr. James H. Moy (948-8210, 948-8663) or Dr. Edison W. Putman (948-8750, 948-7330). Part of Monday will ordinarily be reserved for routine testing and maintenance. Requests for use during irregular University hours should be made to one of the Supervisors.

Operational Hazards and Control:

The operation of a 42,500 curie source of Cobalt-60 (Jan. 1965; upgraded to 27,700 curie, July, 1968; further upgraded to ca. 42,500 curies, February, 1978) is potentially hazardous. In a remote emergency, it is possible that an act of carelessness could result in a critical level of exposure to personnel.

Radiation safety and exposure are controlled by the Federal Code of Regulations, Title 10, Part 20, and by licensing agreements with the NRC.

All personnel employed at or responsible for the irradiation facility, or those who frequently visit or conduct research at the facility, must be acquainted with the radiation safety controls and standard operating procedure. The personnel must recognize the systems which warn of danger, and must report promptly to the supervisors any warning or malfunction.

Two potential operational hazards exist with the Cobalt-60 Irradiator:

(1) direct radiation exposure to gamma-radiation emitted by the source units placed at the bottom of the elevator framework; and (2) Cobalt-60 contamination which might leak from the source units and be transferred to personnel or experimental equipment via the pool water.

The design and proper operation of the irradiator reduce these risks to an acceptable level of exposure.

Direct Radiation Control:

Maintenance of the pool water level is automatically controlled by a water level probe. Should the water level decrease approximately 3 inches because of evaporation, splashout, or a tank leak, a solenoid-operated valve in a 1" water feed line will open, and the tank will be filled to its proper level. Only if the loss of pool water exceeds 12 gpm will the water level drop to unsafe levels. If the pool water level should drop approximately 10 inches below normal, visual and audible warnings are actuated by the Victoreen 808 pool monitor which reflect the hazardous nature of the emergency. Emergency action is described in the last section of the SOP.

To prevent an emergency condition resulting from low pool water level, all authorized operators of the facilities are asked to:

1. Assist the facility supervisor in testing the operation of the alarms on request.
2. Visually inspect the water level and be alert to the possibility of a malfunction with the water level control device and solenoid valve.
3. Report promptly any real or suspected malfunction of the water control device, solenoid valve, alarms, and recording systems.

Contamination Control:

The presence of ionic or particulate Cobalt-60 in the pool water must be suspected at all times. Federal regulations specify that Cobalt-60

contamination in excess of 5×10^{-5} μc per ml of water must be restricted from the public domain (CFR-10). State of Hawaii regulations allow 0 tolerance of same. To minimize the hazard associated with water-borne contamination, personnel are requested to observe the following instructions:

1. Visually inspect and record the radiation level indicated by the Victoreen 808 monitor located adjacent to the ion exchange filter. Report promptly any reading in excess of 5 mr/hr. Emergency warning signals are actuated at 10 mr/hr.
2. Refrain from introducing extraneous material into the pool. Guard particularly against placing soiled equipment or samples into the pool water.
3. Do not splash equipment into the tank. When removing equipment from the pool water, allow excessive water to drain back into the tank.
4. Assist the facility operator in siphoning dirt and debris from the pool bottom at weekly intervals or more often when needed by using existing recirculating system and permutit filters.

Warnings:

Emergency action is signaled by the following audible and visual alarms:

1. High radiation readings at the pool surface monitor station of 0.35 mr/hr. actuating audible and red light alarms on the monitor and at outer door of HRI.
2. A high contamination level of 10 mr/hr. of Cobalt-60 in the filter unit actuating the same alarm system.
3. A power failure in the control and alarm circuits is indicated when the white light is off. Safety devices, alarms, and the recirculation system are powered by a separate key-locked circuit which must remain on at all times.

Emergency Action:

When any warning condition exists, it should be reported to the supervisors promptly. If a red light and audible alarm condition exists, it could mean that the laboratory areas adjacent to the irradiator are being subjected to dangerously high levels of radiation. In this emergency, the area MUST be evacuated of all personnel within one minute and the supervisors should be notified at once. Actuated alarms will operate continuously and

must be reset by one of the supervisors.

Facility Operation:

1. The source room will be kept locked at all times when not in use. Keys will be maintained only by supervisory personnel. All personnel entering the source room must register in the personnel log upon entry and exit. Operators must secure and lock access to the source room whenever they are not actually in the area.
2. Operation of this facility in accordance with SOP does not expose guests or employees to risks beyond the levels established by the Federal NRC standards. Since public education and interest are encouraged, visitors are welcomed but must become the responsibility of the research or authorized operator when in the laboratory area. Guests must register and may enter the source room only in the company of the supervisor or authorized operators, who must wear assigned film badges when in the source room.
3. The date, time, user's name and department, and central chamber or wet tube used should be recorded in the facility log, together with information on materials irradiated and dose administered.

Weekly Test (Mondays):

1. The circulation system of the irradiator pool, the water level, and the radiation level above the pool are checked weekly.
2. Place standard Cobalt-60 source on the calibration point of the pool surface monitor/detector. Note operation of alarm and red light. Record level of exposure indicated by the monitor. Reset alarm.
3. Place standard Cobalt-60 source next to the ion exchange column monitor/detector station. Note red light and radiation level indicated at the monitor. Remove source and reset alarm.

Standard Check-in and Check-out Procedures:

1. Check lights on building-----Red = danger, White = OK
2. Put on film badge.

3. Turn on area survey meter, check batteries, and survey area.
4. Observe through source room door the reading on pool monitor. Note: small white light must be on at all times.
5. Unlock source room door and check area with survey meter.
6. Check water level; observe reading on deionizer radiation monitor. Note: small white lights on this monitor and on the water level adjustment unit must be on at all times.
7. Following irradiation or area-surveying, lock door of source room, deposit badge and check out in the personnel log.

Personnel to be Contacted in Emergencies:

Dr. James H. Moy	Campus: X-8663, X-8210	Home: 235-3812
Dr. Edison W. Putman	X-7330, X-8750	949-6375
Mr. Roy Y. Takekawa	X-8660, X-6805	941-6379
Mr. Thomas Bauer	X-8591, X-8660	947-9664

ADMINISTRATIVE PROCEDURES

HAWAII RESEARCH IRRADIATOR

Amendment No. 2 to Supplemental Information, Licensing Requirement for Gamma Irradiator for University of Hawaii (Ref.: Item H).

SUPERVISORS

The Hawaii Research Irradiator (HRI) is under the direct supervision of Dr. James H. Moy and Dr. Edison W. Putman, as recorded in the NRC Operational License held by the University of Hawaii. Entry to and use of the facility may be made only by personnel authorized by the two supervisors.

AUTHORIZATION OF OPERATORS

Authorization for use of the Hawaii Research Irradiator will be given only to selected personnel cleared by the supervisors. Authorization will be made only under the following circumstances:

1. All operators must be employees of the University of Hawaii or of the United States Department of Agriculture or of an agency of the State of Hawaii, or of a laboratory in the State of Hawaii.
2. Operators must complete training sessions under the supervisors, and show satisfactory knowledge of radiation principles, radiation protection, and radiation health physics. Training sessions will cover thoroughly the design of the facility, radiation monitoring equipment, and standard operating procedures. Consecutive training sessions will be 3-4 hrs. for basic and applied topics.
3. All operators will be expected to be thoroughly familiar with Standard Operating Procedures (SOP) of the facility, and to adhere strictly to them.
4. Authorization for use of HRI will be suspended in cases of any departure from SOP, or in case of resignation or retirement of the employee.

IMPLEMENTATION OF STANDARD OPERATING PROCEDURES, HRI

1. A list of all personnel authorized to use the HRI, including supervisors, will be kept posted at all times on the door of the facility, and copies filed with the Principal Investigator, Dr. James H. Moy and the Director of Research, Dr. Howard P. McKaughan.
2. Keys to the HRI facility will be issued only to supervisors, made available upon request only to authorized operators, and returned promptly to supervisors following use.
3. Operators will adhere strictly to SOP regulations, entering the facility only with approval of supervisors, logging in and monitoring the area prior to entry as specified in SOP.
4. Operators will be responsible for reporting immediately to super-

visors any evidence of radiation hazard or water loss, as specified in SOP, any malfunction or defects in operating equipment, and any unauthorized entry to the facility. Failure to follow these instructions will result in suspension of authorization for use of the irradiator facilities.

LEAK TEST PROCEDURES

HAWAII RESEARCH IRRADIATOR

Amendment No. 3 to Supplemental Information, Licensing Requirement for Gamma Irradiator for University of Hawaii (Ref.: Item K)

Prior to installation in Hawaii, the 100 Cobalt capsules of HRI were tested individually, for Cobalt-60 leakage at Brookhaven National Laboratory, and determined to be free of defects. Samples of water from the lead shipping casks were also tested upon arrival of the facility in Hawaii, and no measurable radioactivity detected. Continued testing for Cobalt-60 leakage will be made on a regular basis at HRI through radioactivity records on pool water and regular inspection of the monitor operating on the ion exchange column. Amended leak test procedures follow:

1. Normally, no water loss will be permitted from the HRI tank of approximately 300 cu. ft. or 2250 gals. In the event water loss is deemed necessary by the supervisors for any reason, radioactivity counts of surface water must be made to confirm that the water is safely within levels specified by Federal regulations, namely, that water concentrations in excess of 5×10^{-5} μ c of Cobalt-60 (110 disintegrations per minute) per ml. of water must be restricted from the public domain. Hawaii State regulations allow 0 tolerance of same.

2. In addition to leak test samples made prior to water removal, top and bottom water samples from the tank will be collected monthly for the first six months of operation, and at six-month intervals thereafter, and radioactivity counts recorded.

3. Water samples will be examined for radioactivity twice a year with Scintillator-detector attachment in the Radioisotope Lab of the Radiation Safety Office, Bldg. 37, of the University of Hawaii at Manoa.

4. Standardized water samples will consist of 5 cc of water evaporated to dryness in standard planchets. All readings, inclusive of background counts and calibration controls, shall be recorded in the HRI Operational log book.

5. In the event that any sample exceeds background by 10 counts per minute, supervisors shall be notified and use of the facility suspended until replicated samples are taken. Such samples shall consist of 10 cc or 100 cc of water evaporated to dryness and tested under similar conditions. Confirmation of suspected Cobalt-60 contamination will be sought, if necessary, using ion exchange columns and appropriate calibration solutions.

6. In the event that repeated tests confirm the presence of Cobalt-60 leakage to the pool water of HRI, all operations of the facility shall be suspended, water loss assiduously avoided, and the area appropriately posted.

An Emergency situation shall be called, and information immediately brought to the attention of the U. H. Radiation Safety Committee,^{and} the Nuclear Regulatory Commission (NRC).

Action to identify and dispose of a leaking source would be made under the supervision of the Nuclear Regulatory Commission with assistance requested from the maintenance contractor for the facility, if available.

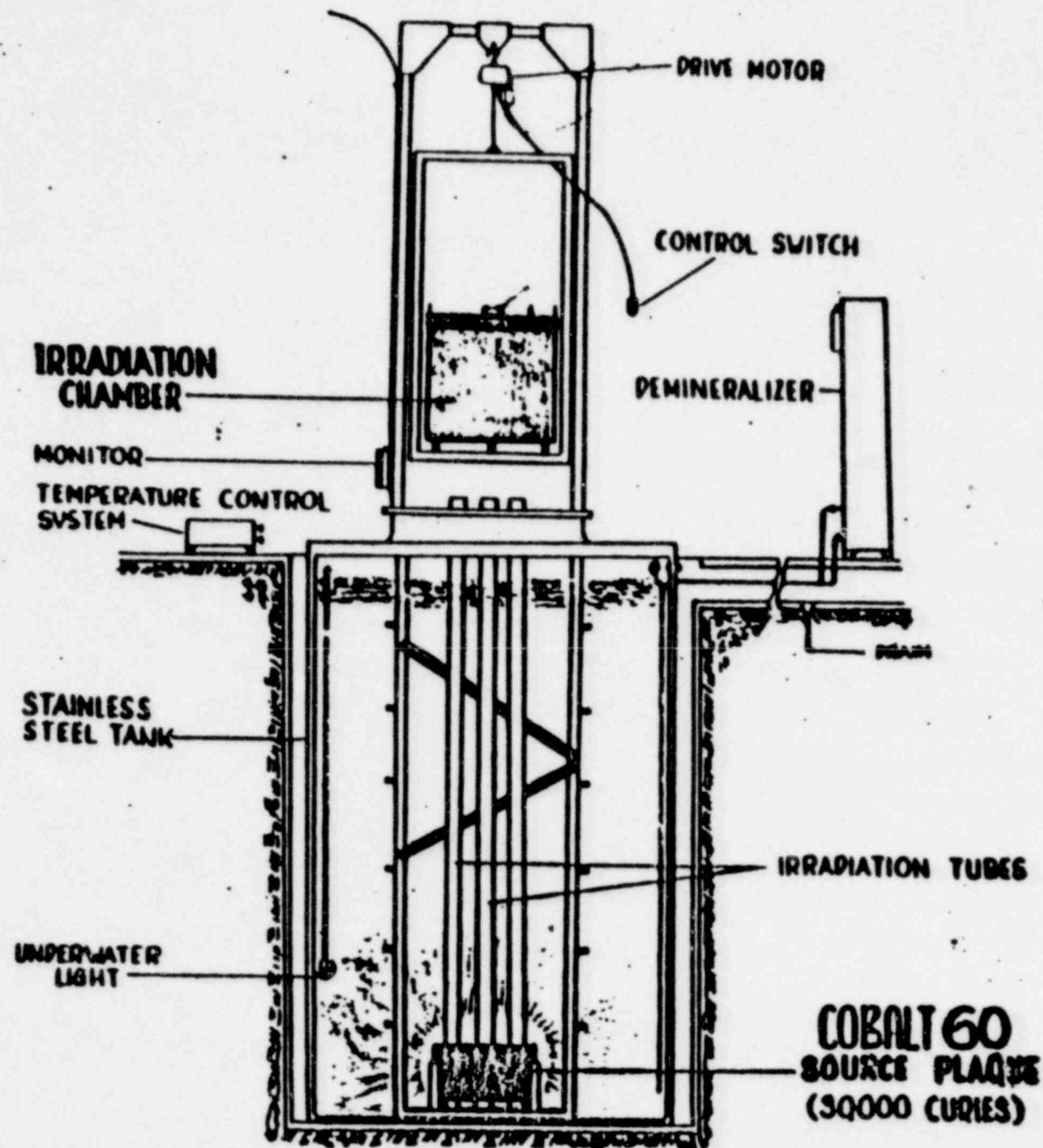


FIG. 1 - HAWAII RESEARCH IRRADIATOR (HRI)

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Hawaii Research Irradiator (HRI) 7

