

Princeton University

Office of Occupational Health & Safety

James Forrestal Campus  
Princeton, New Jersey 08544  
609-452-5294

Re: License No. SNM-356  
Docket No. 070-00391  
Control No. 03276

September 20, 1985

John E. Glenn, Ph.D.  
Chief, Nuclear Materials Safety Section B  
Division of Radiation Safety Safeguards  
U.S. Nuclear Regulatory Commission  
Region I  
631 Park Avenue  
King of Prussia, PA 19406

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Pg

Dear Dr. Glenn:

This is in response to your letter of June 26, 1985, regarding our request for renewal of license number SNM-356. The additional information you requested follows:

1. The following criteria are used to determine the frequency at which individual investigators are required to perform surveys.
  - a. Personal and work area contamination surveys are required at the end of an experimental procedure and at the end of the day for multi-day procedures.
  - b. Personal and work area contamination surveys are required during the manipulating of millicurie quantities of open sources. Because of the diversity of the radioactive materials and the experimental procedures performed in research activities at the University, the frequency and the timing of this type of survey is best left to the judgment of the individual performing the experiment.
  - c. Personal and work area contamination surveys are required during and following the opening of radioactive materials packages.
  - d. Personal and work area contamination surveys are required following withdrawals from stock solution vials containing millicurie quantities.
  - e. Personal contamination surveys are required prior to exiting the restricted area.

In developing the above criteria, the recommendations in Regulatory Guide 8.23 - Radiation Safety Surveys at Medical Institutions - were adapted to the academic environment.

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Decontamination is required when removable surface contamination equals or exceeds the limits recommended in Table II of Regulatory Guide 8.23. Sections 10.D and 10.E of the Radiation Safety Guide will be revised to reflect the above.

2. Our criteria are stated in Section 11.B of the Radiation Safety Guide.

As a matter of practice, whole body personal monitors are provided to individuals who use or are exposed to sources of neutrons, photons and/or beta radiation sufficient to be measured by the personal dosimeter. Additionally, individuals who actually manipulate these sources are provided with TLD ring badges and/or wrist badges. Specifically, individuals who manipulate millicurie quantities of P-32 and I-125 are issued and required to wear finger dosimeters.

Section 11.B of the Radiation Safety Guide will be revised to include the requirement that finger dosimeters be worn when manipulating millicurie quantities of P-32, I-125 or other sources that may cause significant hand exposure.

3. It is confirmed that all individuals, including post-doctoral research staff, will receive initial and annual refresher training in accordance with the requirements in 10 CFR 19.12. The applicable sections of draft Regulatory Guide, Task OP 212-4, "Radiation Protection Training for Personnel Employed in Medical Facilities", are being used as a model for this training. It provides guidance for documentation and training session content.

While radiation safety training provided by the Health Physics Staff for radiation workers is in place, other training sessions for ancillary personnel are being improved or developed. This effort is in progress and will be completed no later than December 31, 1985.

Section 6.I of the Radiation Safety Guide will be changed to reflect the above.

4. The Health Physics Staff have calibrated radiation measuring instruments since the inception of the SNM License. The information you request follows:

a & b)	Manufacturer's		Nuclide	Quantity
	Serial #	Model #		as of 9/1/85
	M-742	N/A*	Pu-239	1 Ci
	M-941	N/A*	Pu-239	1 Ci

\*Sources manufactured by Monsanto Chemical Company - Mound Laboratory, Miamisburg, Ohio

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- c) The above sources have been calibrated by the National Bureau of Standards (NBS) or have calibrations traceable to the NBS. The calibration information is on file at the Office of Occupational Health and Safety.
- d) The following are the step by step procedures, including the associated radiation safety procedures used during the calibration of our exposure rate measuring instruments. The applicable sections of ANSI N323-1978 were followed in developing these calibration procedures.

#### Precalibration Testing of Instrument

A precalibration test is performed to assume that operating requirements specified by the instrument manufacturer are met. The following tests constitute precalibration:

- 1) The instrument is determined to be free of radioactive contamination.
- 2) The battery complement is checked for proper type, condition, and output.
- 3) The meter is turned on and allowed to stabilize.
- 4) Range switches and meter readout are checked for proper functioning.
- 5) Electronic adjustments are set to manufacturer's specifications.
- 6) The zero is adjusted. The control is checked for proper functioning. The zero reading is observed - watch for excessive drift or instability.
- 7) Unusual switching transients are noted.
- 8) The response time is checked.
- 9) If the instrument fails any of the above tests in steps 1 through 8, terminate the calibration and refer the problem to the Health Physicist.

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### Calibration Tools

The following items are needed to calibrate neutron survey instruments:

- 1) A neutron source of a known dose rate. This is a source calibrated by NBS or a calibrated source traceable to NBS.
- 2) An instrument calibration assembly to accurately measure the distance from the center of the source to the center of the chamber and to assure that positioning errors are minimized.
- 3) Tools for making adjustments.
- 4) An accurate timing device or time indicator to calibrate integrating instruments.
- 5) The appropriate instruction manuals.

### Calibration Set Up

Set up instrument on the calibration table. The neutron survey instrument is calibrated in the same orientation as that used in the field. The neutron detector is positioned a known distance from the neutron source. The distances are center to center. The moderating sphere of the neutron detector is placed on the end of the table to minimize scattering. The neutron source is placed on a tripod. This operation is performed in the center of the calibration facility to minimize scattering.

### PRIMARY CALIBRATION

#### Reproducibility Test

The survey instrument is tested at a dose rate value that occurs at the mid-point on each scale of interest. The instrument is exposed three or more times under identical conditions on each range of interest. The reading on each scale shall not vary by more than  $\pm 10$  percent ( $\bar{X} \pm 0.10 \bar{X}$ ). This test is performed prior to making calibration adjustments. The calibration data generated from all the tests are recorded on a calibration data sheet, OHS Form #87 (see attached).

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#### Readout Scale & Linearity Calibration & Adjustment

If controls are provided for each scale, adjustment of each shall be made according to the manufacturer's specifications or at the mid-point of each scale. If only one control is provided, adjustments shall be made either:

- 1) At the point specified by the manufacturer.
- 2) Near the mid-point of the middle scale.
- 3) Near the mid-point of the scale that is particularly important to our requirements.

After this adjustment, the calibration shall be checked near the ends of each scale (approximately 20 percent and 80 percent of full scale). After an adjustment or adjustments have been completed, instrument readings must be within  $\pm 10$  percent of known radiation values at these two points. However, readings within  $\pm 20$  percent shall be acceptable if a calibration chart or graph (containing correction factors) is prepared and made available with the instrument.

A neutron survey instrument with integration capabilities is calibrated by exposing the detector to a known amount of neutrons within accurately measured time periods. The count at the end of the timing period is normalized to a neutron dose. The timer is electronic and integral with the instrument.

#### Calibration Frequency

Pre- and primary calibration is performed nominally at six month intervals.

#### Radiation Safety Considerations

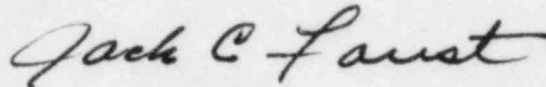
The sources used for calibration are one Curie PuBe sources and do not present an immediate danger to the calibrator. The calibrator minimizes his exposure by working as efficiently as possible and at sufficient distances to limit his exposure. Sources are manipulated with handling tools. Ring, wrist and body dosimeters are worn by the calibrator during the entire process.

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We trust that the information provided above meets your needs and that you can now proceed to review our renewal application for the subject license. We are in the process of making the revisions to our Radiation Safety Guide; the commitments made above will be reflected in that revision. Changes to the Radiation Safety Guide will, as in the past, be forwarded to you as soon as they have been completed. Thank you for your cooperation.

Very truly yours,



Jack C. Faust  
Director

JCF:lt

cc: Radiation Safety Committee  
Committee On Occupational Safety and Health  
file 9.2

Attachment: OHS Form #87

PRINCETON UNIVERSITY - OFFICE OF OCCUPATIONAL HEALTH & SAFETY

CALIBRATION DATA SHEET

EQUIPMENT \_\_\_\_\_ DATE \_\_\_\_\_ TEMPERATURE \_\_\_\_\_  
 MODEL \_\_\_\_\_ TIME \_\_\_\_\_ HUMIDITY \_\_\_\_\_  
 MANUFACTURER \_\_\_\_\_ CALIBRATION FACILITY \_\_\_\_\_ ATMOSPHERIC PRESSURE \_\_\_\_\_  
 SERIAL NO. \_\_\_\_\_ CALIBRATOR \_\_\_\_\_ AIR DENSITY CORRECTION FACTOR \_\_\_\_\_  
 DEPARTMENT \_\_\_\_\_ CALIBRATION GEOMETRY \_\_\_\_\_

SOURCE	DISTANCE	DOSE RATE	SCALE	READING	% ERROR	% ERROR REPRODUCIBILITY TEST

PRECALIBRATION CHECK LIST:

- FREE OF CONTAMINATION ☐  
 BATTERY CHECK ☐  
 TWO MINUTE STABILIZATION ☐  
 RANGE SWITCHES & READ OUT ☐  
 ELECTRONIC ADJUSTMENTS ☐  
 ZERO ADJUST ☐  
 SWITCHING TRANSIENT CHECK ☐  
 RESPONSE TIME ☐  
 RECORD A.P. TEMP HUMIDITY ☐