reid memorial hospital

May 20, 1977

John E. Bowyer
Radioisotopes Licensing Branch
Division of the Materials and Fuel Cycle
Facility Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Reid Memorial Hospital
Richmond, Indiana 47374
Lic. #13-03284-02

I request ammendment of our isotope license to permit us to use Xenon-133 for ventilation lung scanning. We request a possession limit of 1000 mCi. of 133 Xenon gas.

This request for ammendment will follow your guide for supporting documentation for 133 Xe use.

A. Quantities To Be Used

1. We estimate approximately 500 patient studies per year (actual 219 in 1976) and estimate that we will use approximately 20 mCi. of 133 Xe per patient.

2. We request a possession limit of 1000 mCi. of 133 Xenon gas.

B. Use and Storage Areas

Copies of our hospital architect plans are included for your orientation. Our Picker 3-C gamma camera is located in area #145 with the desk controls in area #147. Xenon storage will be in the lab area, #141. 2" lead brick shielding is available and will be used around the hood storage area and the hood will be vented with 100% exhaust to the outside. The nearest unrestricted area is the patient corridor #165, which is 8' from the proposed Xenon storage hood in the lab.

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The Xenon shipment will be stored in it s lead shipping cylinder behind the 2" lead brick under the exhaust hood in the designated lab area #141. The un. dose of 20 mCi. of 133 Xenon will be contained in the le. l dispenser and will be administered in area #145.

2. The current 100% exhaust ventilation s em for room areas #143-145-147 has a current exhaust rate of 430 CFM. There is no air re-circulation from these areas.

In addition to the above, we propose to install additional exhaust capability. Located approximately 4' directly overhead is a completely separate second exhaust system which exhausts the stale air from several restrooms. This second system fan has a capacity of 5000 CFM of which only 2800 CFM is being currently used. We propose to add the following:

(i) Exhaust the Xenon storage hood to this system.
(ii) Install new duct work, creating an exhaust vent essentially at the feet of the patient being examined with Xenon.

C. Procedures for Routine Use

1. The patient will be attached to the disposable Xenon-133 re-breathing system with a disposable mouthpiece. The re-breathing system contains oxygen and a CO2 absorber. The unit dose of Xenon-133 will be injected into the tubing of the system and the appropriate images obtained.

2. It is our intent to purchase the roughly $5500.00 Xenon-133 lung function unit of Nuclear Associates, Inc. and the approximately $1000.00 "Nonex" Xenon gastrap, also from Nuclear Associates, Inc. The product brochure is enclosed.

se clamps will be used.

gency edures:

e enclosed emergency procedure protocol.

E. Room Release and Air Concentrations of 133 Xenon in Restricted Areas

1 Estimate of the maximum amount of activity to be used per week (A).

10 patients per week, using approximately 20 mCi. per patient or a total of 200 mCi./week ($A=2x10^5$ uCi/wk).

2. Estimate of the fraction of 133 Xenon that is lost during

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use and storage (f). Leakage as ned at 25%.

Assume $1x10^{-5}$uCi./ml are releas to the room, and assuming 10 patients per week, assuming 20 mCi. per patient and assuming a leakage of .25.

The volume of air (exhaust) needed per week for dilution.

$$\text{Volume} = \frac{2x10^5 \text{uCi/week} \times 0.25}{1x10^{-5} \text{uCi/ml}} = 5 \times 10^9 \text{ml/week}$$

$$\text{Ventilation rate required} = \frac{5x10^9 \text{ml/week}}{40 \text{ hours/week}} \times \frac{1 \text{cfm}}{1.7x10^6 \text{ml/hr}} - 74 \text{ cfm}$$

We have and are currently using an existing exhaust rate of 430 CFM in Room 143-145-147.

We have up to 2200 CFM from the exhaust system which we propose to install.

Therefore, I conclude our exhaust capabilities are adequate.

F. Hood Exhaust Release Methods of 133 Xenon Disposal

1. Dilution through exhaust systems. Hood exhaust release.

   (a) Our estimate of the maximum amount of 133 Xenon to be released per year (A).

   Activity per year:

   $$\frac{250 \text{mCi}}{\text{week}} \text{ (average per week)} \times 0.25 \times \frac{52 \text{ weeks}}{\text{year}} = 3.2 \times 10^6 \text{uCi/yr.}$$

   (b) Exhaust system flow rates were measured by the traverse method using the velocity probe from ALNOR series 6000-P Velometer of ALNOR Instrument Co., 7301-North Caldwell Av. Niles, Illinois 60643.

   (c) Airflow per year:

   $$(V) \frac{1000 \text{ ft}^3}{\text{min.}} \text{ (minimum)} \times \frac{1.49 \times 10^{10} \text{ ml}}{\text{ft}^3\text{/min.}} - 1.5 \times 10^{13} \text{ ml/year}$$

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(d) Calculation of the ave: oncentration for unrestricted areas following formula

$$C = \frac{3.2 \times 10^6 uci/year}{1.5 \times 10^{13} ml/year} = 2.1 \times 10^{-7} uCi/ml$$

which is less than 3 x 10^{-7}uCi/ml

2. Adsorption onto Charcoal Traps

a. The problem of leakage from the trapping device is handled as an emergency procedure (see enclosure).

b. To irsure that collection and trapping devices are performing according to specifications, the trap will be monitored with the Picker G.M. counter at the port of entry and exit.

c. The Xenon-133 Nonex Gas Trap is designed to absorb sufficient radioactivity to assure safe levels (an effluent concentration less than 1×10^{-5}uCi./cm^3) when testing a reasonable number (10) of patients per week. The trap contains a 5 cartridge tandem pack with an anticipated cartridge life of approximately six months. The unit is self-contained and is to be stored for physical decay (background survey reading) before disposal.

Copy

John C. Spellmeyer, M.D.
Director
Department of Radiology

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24. MISCELLANEOUS

A. DOSAGE SCHEDULE

Thyroid function studies and scans	^{131}I-NaI	100 µCi
Placenta localization, plasma and blood volume studies	^{131}I or ^{125}I-HSA	5 µCi
Kidney function studies	^{131}I-hippuran	20 µCi
Fat absorption studies	^{131}I-fatty acids	50 µCi
Treatment of hyperthyroidism	^{131}I-NaI	50 mCi
Cardiac dysfunction and thyroid carcinoma	^{131}I-NaI	200 mCi
Lung scans ZENON 133 20mCi	^{131}I-MAA	300 µCi
Kidney scans	^{99m}Tc-DTPA	2 mCi
In vitro studies	^{131}I-iodysamide Na	---
Diagnosis of pernicious anema	^{58}Co or ^{60}Co-Vit B-12	0.5 µCi
Red blood cell mass and survival studies	^{51}Cr-chromate	20 µCi
Gastrointestinal protein loss studies	^{51}Cr-HSA	50 µCi
Iron metabolism	^{59}Fe-citrate	20 µCi
Intracaviatry treatment of pleural and peritoneal effusions	^{32}P-colloidal phosphate	15 mCi
Polycythemia vera and leukemia and bone metastases	^{32}P-soluble phosphate	25 mCi
Intracavitary treatment of pleural and peritoneal effusions	^{197}Au-colloidal suspensions	150 mCi
Brain scans	^{99m}Tc-pertechnetate	15 mCi
Interstitial treatment of Ca	^{192}I-stainless steel	200 mCi
Treatment of eye and skin diseases	^{90}Sr-sealed source	50 mCi
Interstitial and intracavitary treatment of Ca	^{137}Cs-sealed sources	200 mCi
Liver scans	^{99m}Tc-sulfur colloid	1 mCi
Bone scans	^{99m}Tc-polyphosphate	8 mCi
Pancreas scans	^{75}Se-selenomethionine	250 µCi

B. 1. Confirm that every ^{99m}Tc-elution assayed for ^{99m}Tc activity and ^{99}Mo breakthrough; eluate not used if ^{99}Mo breakthrough is more than 1 µCi per mCi of ^{99m}Tc or more than 5 µCi of ^{99}Mo per administered dose of ^{99m}Tc

2. Confirm that all instructions supplied by generator or kit manufacturer are followed for elution, assay, kit preparation, radiation safety precautions (Pb shields for elution vials, Pb shielded syringes).

C. Licensed material shall be used by, or under the supervision of John Spellmeyer, M.D., or John R. Dehner, M.D. Licensed material for diagnostic procedures, Iodine 131, and phosphorus 32 treatment may also be used by, or under the supervision of John V. Cooke, M.D. Licensed material for diagnostic procedures, Iodine 131, phosphorus 32 and gold 198 treatment may also be used by, or under the supervision of Richard M. Butler, M.D. Byproduct material listed in Section 31.11(a) of 10 CFR 31 and Nickel-63 source may also be used by, or under the supervision of Olin K. Wiland, M.D.

RADIATION SAFETY MANUAL
NUCLEAR MEDICINE DEPARTMENT

REID MEMORIAL HOSPITAL

RICHMOND, INDIANA

RADIATION PROTECTION MEASURES

A. External

The basic protective measures to reduce external radiation are time, distance, and shielding. In every situation these three factors must be considered jointly. While shielding is desirable in reducing the exposure, it must not be overlooked that doing the job in one-half the time is just as effective as doubling the shielding. Working twice as far from a point source is as effective as using 4 times as much shielding. Continuous use of monitoring equipment is the best method of evaluating the hazard and reducing the expsoure. Every user of radionuclides should have on hand adequate survey instruments to keep check on his operations.

B. Internal

The prevention of internal exposure is more exacting and less easily performed than is that of external exposure. The maximum permissible levels of radioactive contamination in the air or on laboratory surfaces is of such a low level that they cannot be detected with ordinary survey instruments. If a low level contamination is suspected (anytime there is a spill), contact the radiation safety officer for a survey. The general policy is the use of radioisotopes is to use such equipment of ingestion of radioisotopes into the body. Outlined below are general rules and procedures for this purpose.

1. Eating, drinking, smoking and use of cosmetics are not permitted in laboratories or rooms where radioactive materials are used or stored.

2. Solutions shall not be pipetted by mouth.

3. Protective clothing appropriate to conditions shall be worn. A laboratory coat and gloves are the minimum protective clothing to be worn. PROTECTIVE CLOTHING IS NOT TO BE WORN OUTSIDE THE LABORATORY. i.e. offices, counting rooms, etc, NEVER WEAR LABORATORY COATS TO THE CAFETERIA. Monitor clothing before it is returned to laundry.

4. Wash hands thoroughly before leaving the laboratory.

5. If contamination is suspected, all work shall be halted immediately and the radiation safety officer contacted to evaluate the condition and give advice.

6. All injuries shall be monitored to determine possible contamination. (call radiation safety officer at once).

7. Special protection is required for wounds so as to prevent the entry of radioactive materials. Waterproof adhesive tape should seal any other bandaging.

8. Everything in the laboratory or room is to be considered contaminated and should be monitored before removing from the laboratory.

9. All persons issued monitoring equipment (film badges, etc.) shall wear the issued equipment at all times when in or near radiation areas. They shall not wear them at home.

10. All persons working with radioactive materials shall be be aware of radiation safety procedures. The principal investigator is responsible to see that his people have been properly trained.

11. Radioactive material shall be used and stored in a way which prevents unauthorized access to radioactive materials.

12. All containers for radioactive material shall be properly labeled (per 10 CRF, part 20).

C. Handling Procedures

1. Radioactive materials are to be handled only by persons aware of the hazards of the material.

2. The shipping container shall be opened and treated as though it were contaminated inside until monitored to prove differently.

3. When handling radioactive material (except in the shipping container) personnel shall wear gloves and work on a surface covered with absorbent paper or equivalent material.

4. Remote handling equipment will be used when the external radiation of a container exceeds 38 mR/hr as 1 centimeter (maximum permissible exposure rate to hands and forearms).

5. To reduce the risk of spills to a minimum:

    a. use double containers
    b. use protective covering and lids
    c. use unbreakable containers to store radioisotopes
    d. use caution in transfers - try a "dry run" without using radioactive materials
    e. use dry box for duty materials
    f. use propipettors - never pipette by mouth
    g. use absorbent paper or equivalent to cover work surface to contain any possible spills

D. Good Housekeeping Habits

Much of the job of preventing the spread of contamination is a matter of good housekeeping.

a. Keep the laboratory neat and clean. Keep the work area free of equipment and materials not required for the immediate procedure.

b. Wash hands and arms thoroughly before handling any object which goes to the mouth, nose or eyes. Monitor the hands whenever contamination is suspected and decontaminate immediately.

c. Keep fingernails short and clean. Do not work with radioactive materials if there is a break in the skin below the wrist unless the wound is so protected that radioactive materials cannot gain access to the body. Cover the break with tape (waterproof) and wear a rubber glove.

E. Restriction and Labelling of Radiation Areas

All radiation areas are to be properly labelled and as such to be restricted from entrance by unauthorized personnel. The design of the Radiation Symbol is given in Section 20.203 of the Federal Register, Chapterl, Part 20. A sign bearing the radiation caution symbol and the words "Caution High Radiation Area" will be posted when the level in such an area is such that a major portion of the body could receive in any one hour a dose in excess of 100 millirem. A sign bearing the radiation caution symbol and the words "Caution Radiation Area" will be posted when the level in such an area is much that a major portion of the body could receive in any one hour a dose in excess of 5 millirem. A sign bearing the radiation caution symbol and the words "Caution Airborne Radioactivity Area" will be posted

when any room, enclosure, or operating area in which airborne radioactive materials exist in concentrations in excess of the amounts specified in Appendix B of the Federal Register, Chapter 1, Part 20, Table 1, Column 1. A sign bearing the radiation caution symbol and the words "Caution Radioactive Materials" will be displayed on each container in which is transported, stored or used a quantity of any licensed material greater than the quantity of such material specified in the Federal Register, Chapter 1, Part 20.

Form AEC-3 "Notice to Employees" will be posted in a sufficient number of places where employees are engaged in activities licensed by the Commission to permit them to observe a copy on the way to and from their place of employment.

F. Monitoring and Survey

Each person is responsible for monitoring his personal clothing, shoes, and laboratory equipment. Each laboratory and/or special project is responsible for providing appropriate survey devices.

1. Personnel Monitoring

   a. Film Badges

   Any person who has a probability of being exposed to significant amounts of external radiation should be issued a film badge.

   b. Pocket Dosimeters

   Personnel working with any source of radiation where a daily exposure of more than 10 millirem is possible, must wear a pocket chamber. As a rule of thumb, if the radiation levels exceed 20 mR/hr at any point, pocket chambers are called for.

   c. Survey Meters

   The radioisotope laboratory must have a working survey meter. This will usually be of the Geiger-Mueller type. This instrument is for the use of personnel in the laboratories to check for contamination and is suitable for such routine use of:

      1. Checking laboratory surfaces, glassware, and tools for beta-gamma contamination.

      2. Checking hands, shoes, and clothing.

3. Measuring the radiation level from low level sources (less than 20 mR/hr).

2. Laboratory Monitoring and Survey

Periodic monitoring of the nuclear medicine laboratories will be conducted. There will be a floor plan of each laboratory. During the periodic checkup, recorded on this floor plan will be dose rates measured at various points such as sinks, lab tables, hoods and handling equipment using the appropriate survey meter. Also recorded on this floor plan will be a wipe test of the most frequently used areas. This wipe will be made with a piece of moistened filter paper or cotton applicator and depending on the type of source present, counted for either beta and/or gamma radiation. Each sealed source, containing byproduct material with a half-life greater than thirty days shall be tested for leakage and/or contamination. The test shall be performed on the sealed source surface or on the accessible surfaces of the device in which such source is permanently or semipermanently mounted. The tests will be performed using moistened cotton applicators of filter paper. Wipes will be counted with appropriate instrumentation to determine radioactivity. Records of leak test results will be maintained by the Radiation Safety Officer. These tests will be performed every six months. Servicing, maintenance and repair of source will be performed by source supplier.

G. Calibration of Survey Meters

All survey meters used routinely in the Radiation Safety Program must be calibrated annually. Upon completion of the calibration an instrument calibration record will be posted on the survey meter indicating the date of calibration.

H. Permissible Exposures

The maximum permissible external exposure for personnel occupationally exposed is 100 millirem per week.

The maximum permissible average body burden of radionuclides for persons outside of the controlled area and attributable to the operations within the controlled area shall not exceed one-tenth of that for a radiation worker, i.e., 10 millirem per week.

Persons under 18 years of age shall not be occupationally exposed to ionizing radiation. Their yearly exposure shall not exceed 0.1 rem per year from educational activities.

Students over 18 years of age shall not receive exposures exceeding 0.5 rem per year in addition to natural background and medical exposures.

I. Contaminated Equipment

Radioactive contamination is defined as the deposition of radioactive material in any place where it is not desired and particularly in any place where presence may be harmful. Contaminated equipment shall not be used again until properly decontaminated.

Equipment that may be re-used should be decontaminated. Contaminated equipment is no longer of any use may be discarded in the dry active waste can. If too large for such disposal, request a survey and disposal information from the Radiation Safety Office.

J. Instruction for Visitors

All protection measures pertinent to personal safety mentioned above apply to all visitors. No visitors are permitted in any laboratory using a radiation source unless accompanied by a qualified individual familiar with the hazards involved. All visitors shall be issued a personnel monitoring device when they enter an area in which radioactive materials are located in such amounts that they constitute a potential personnel hazard or increase the possibility for spread of contamination. Accumulated doses shall be recorded for the visitor along with the individuals name, age and address and this information sent in a written memorandum to the Radiation Safety Officer to be kept on file.

STORAGE RADIONUCLIDES

A. Liquid and Solids

It is important that all stored radioactive samples be clearly labelled at all times giving isotope(s) chemical form, the activity and the date of activity, and the name of the responsible investigator.

Storage sites for large amounts of radioactive materials should be as remoted from occupied areas as practicable. Background radiation in unrestricted areas shall be such that individuals continuously in these areas will not receive a dose in excess of 2 millirems in any one hour, or 10 millirems in any seven consecutive days. The whole body exposure in unrestricted areas shall be such that any individual will not receive a dose in excess of 0.5 rems (500 mrem) if any one quarter of one calendar year.

The storage place should be closed so as to minimize risk from fire, and should be provided with a suitable mean of exit. Storage areas must be well-marked with, "caution radioactive materials" signs. The name, address, and phone number of the responsible person, the Radiation Safety Officer, shall be posted in a conspicuous place near the area.

B. Gases

The following requirements listed above in A apply as well as the following consideration: radioactive solutions that emit gases should be labeled and kept in approval hoods which are provided with filters and have adequate ventilation. Only amounts of material necessary for immediate experiments should be stored in the laboratory. For maximum permissible concentration in air, consult the Federal Register, Appendix B, Chapter 1, Part 20, Table I, Column 1.

EMERGENCY PROCEDURES

Emergencies resulting from accidents in laboratories working with radioactive materials will range from simple spills of small amounts of radioactive materials, where no serious contamination problem results, to major disaster occurring from explosions, fires, or natural phenomena. Correspondingly, the hazards resulting from such accidents will cover the range of situations from no hazard whatsoever to very serious situations involving extreme radiation hazards and bodily injury or both. In view of the complicating factors that may arise during such emergencies, simple rules of procedure cannot be set down covering all situations of radiation danger. However, in any emergency primary concern must always be the protection of laboratory personnel from radiation hazards. Second should be the confinement of the contamination to the local area of the accident, if this is possible.

A. Whom to Call and When

In the event of an emergency or suspected emergency, e.q. spills, bodily injury, fire, etc., immediately notify the Radiation Safety Officer:

John V. Spellmeyer, M.D. Office AC 317 962-5152

Home AC 317 966-4970

and Chairman of the Radiation Safety Committee:

John V. Cooke, M.D. Office AC 317 962-5152

Home AC 317 962-7294

Dry Spills:

Don protective gloved
Vacuum clean the contaminated area (under supervision of Radiation Safety Officer). Use a filter having a pore size of 0.2 micron on the exhaust opening of the vacuum cleaner. Central vacuum systems may not be used.

Dampen thoroughly, taking care not to spread the contamination.

6. Decontaminate.

7. Monitor all persons involved in the spill and cleaning.

8. Permit no persons to resume work in the area until a survey is made, and approval of the Radiation Safety Office is secured.

9. Prepare a complete history of the accident and subsequent activity related thereto for the laboratory records with a copy to the Radiation Safety Officer.

D. Major Spills Involving Radiation Hazard to Personnel

1. Notify all persons not involved in the spill to vacate the room at once.

2. If the spill is liquid, and the hands are protected, right the container.

3. If the spill is on the skin, flush thoroughly.

4. If the spill is on clothing, discard outer or protective clothing at once.

5. Switch off all fans and air conditioners.

6. Vacate the room.

7. Notify the Radiation Safety Officer as soon as possible.

8. Take immediate steps to decontaminate personnel involved as necessary.

9. Decontaminate the area under supervision of Radiation Safety Officer (personnel involved in decontamination must be adequately protected).

10. Monitor all persons involved in the spill and cleaning to determine adequacy of decontamination.

11. Permit no person to resume work in the area until a survey is made and approval of the Radiation Safety Office is secured.

12. Prepare a complete history of the accident and subsequent activity related thereto for the Radiation Safety Office records.

E. <u>Accidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors and Gases</u>

1. Notify all other persons to vact the room immediately.

2. Hold breath and close escape valves, switch off air circulating devices, etc., if time permits.

3. Vacate the room.

4. Notify the Radiation Safety Officer at once.

5. Ascertain that all doors giving access to the room are closed and post conspicuous warnings or guards to prevent accidental opening of doors.

6. Report at once all known or suspected inhalations of radioactive materials.

7. Evaluate the hazard and the necessary safety devices for safe re-entry.

8. Determine the cause of contamination and rectify the condition.

9. Decontaminate the area under supervision of Radiation Safety Officer.

10. Perform air survey of the area before permitting work to resume.

11. Monitor all persons suspected of contamination.

12. Prepare a complete history of the accident and subsequent activity related thereto for the laboratory records with a copy for the Radiation Safety Officer.

F. Injuries to Personnel Involving Radiation Hazard

1. Wash minor wounds immediately, under running water, while spreading the edges of the wound.

2. Report all radiation accidents to personnel (wounds, over-exposures, ingestion, inhalation) to the Radiation Safety Officer as soon as possible.

3. Call a physician, qualified to treat radiation injuries, at once.

4. Permit no person involved in a radiation injury to return to work without the approval of the Radiation Safety Officer and the attending physician.

5. Prepare a complete history of the accident and subsequent activity related thereto for the Radiation Safety Office records.

G. Fires or Other Major Emergencies

1. Notify all other persons in the room and building at once.

2. Attempt to put out fires if radiation hazard is not immediately present.

3. Notify the Radiation Safety Officer.

4. Notify the fire department and other local plant safety personnel.

5. Govern fire-fighting or other emergency activities by the restrictions of the Radiation Safety Officer.

6. Following the emergency, monitor the area and determine the protective devices necessary for safe decontamination.

7. Decontaminate under supervision of Radiation Safety Officer.

8. Permit no person to resume work without approval of Radiation Safety Officer.

9. Monitor all persons involved in combating the emergency.

10. Prepare a complete history of the emergency and subsequent activity related thereto for the Radiation Safety Officer records.

DISPOSAL

Records of the amounts, in microcuries, of all radioisotope disposal must be maintained.

Radionuclides are disposed of in the following manner:

A. Decay

If the radionuclide is short-lived, it may be stored until the activity has decayed. When the activity is below the maximum permissible level given in Appendix B of the Federal Register, Chapter 1, Part 20, Table 1, Column 2, the material may be discharged into the sewer. If the half-life is greater than 30 days, this method becomes impractical.

B. Liquid Disposal

1. Sewer Disposal

If the radionuclide is readily soluble or dispersible in water, it may be flushed down the drain providing the activity is below maximum permissible levels. An assay must be made to determine the exact amounts of activity present and the dilution necessary. See Appendix C. (The Federal Register, Appendix B, Chapter 1, Part 20, Table 1, Column 2) for maximum permissible discharge of material into a sanitary sewerage system. Only sinks that are designated as disposal sinks for a particular area may be used. A Radioisotope Record from must be posted near this sink and all amounts disposed of recorded in the appropriate column.

Special consideration for ^{14}C, ^{131}I, and ^{32}P:

If one assumed normal mixing, the problem of disposal of ^{14}C in sewers becomes a straight dilution problem. On this basis, and using the maximum permissible concentration for water, 8×10^{-4} µCi/ml, the permissible amount of ^{14}C that may be discharged to sewers should not exceed 3.64 µCi/gal. of sewage.

In institutions or hospitals it is not possible to formulate simple instructions for disposal of radionuclids excreted by patients. In diagnostic and therapeutic uses of ^{32}P, in diagnostic use of ^{131}I, and in treatment with ^{131}I, rate of the disposal of radionuclides excreted by a particular patient into the sewage must be calculated on the basis of dose, uptake and the rate of waterflow to the sewage treatment plant.

2. Non-Sewer Disposal

If a liquid waste cannot be disposed of by the sewer method, it may be precipitated or evaporated and treated as a solid waste. Care should be takne in handling dry material (i.e. dust)

to prevent air contamination. Or, it can be stored in a properly identified liquid waste container to be disposed of by the Radiation Safety Officer.

C. Solid Wastes

If the radionuclide is water soluble, it may be flushed down the drain providing the activity is below maximum permissible levels. An assay must be made to determine the exact amounts of activity present and the dilution necessary. See Appendix C, (Federal Register, Appendix B, Chapter 1, Part 20, Table 1, Column 2) for maximum permissible discharge of material into a sanitary sewerage system. All other solid wastes whould be stored in steel waste cans or drums to be shipped to a disposal agency. The laboratories which produce solid wastes should have a radioactive waste and disposal of can). This can must be lined with a disposable plastic bag.

REID MEMORIAL HOSPITAL
RICHMOND, INDIANA
RADIOACTIVE WASTE (SEWERAGE)
PERMISSIBLE DAILY DISPOSAL

Assume: Average water flow of 500 liters per day per person, 350 bed hospital, daily flow of 175000 liters per day

RADIONUCLIDE	PERMISSIBLE DAILY WATER CONCENTRATION µCi/ml	PERMISSIBLE DAILY DISPOSAL* µCi
F 18	2×10^{-2} (S)	10000
	1×10^{-2} (I)	10000
P 32	5×10^{-4} (S)	116
	7×10^{-4} (I)	122
Cr 51	5×10^{-2} (S)	10000
	5×10^{-2} (I)	10000
Co 57	2×10^{-2} (S)	3500
	1×10^{-2} (I)	1750
Co 60	1×10^{-3} (S)	175
	1×10^{-3} (I)	175
Fe 55	2×10^{-2} (S)	3500
	7×10^{-2} (I)	11670
Fe 59	2×10^{-3} (S)	350
	2×10^{-3} (I)	350
Se 75	9×10^{-3} (S)	1575
	8×10^{-3} (I)	1400
Sr 85	3×10^{-3} (S)	525
	5×10^{-3} (I)	875
Mo 99	5×10^{-3} (S)	1088
	1×10^{-3} (I)	1000
Tc 99m	2×10^{-1} (S)	35000
	8×10^{-2} (I)	14000
I 125	5×10^{-5} (S)	10
	6×10^{-3} (I)	1050
I 131	6×10^{-5} (S)	11
	2×10^{-3} (I)	350
Hg 197	9×10^{-3} (S)	1516
	1×10^{-2} (I)	1750
Hg 203	5×10^{-4} (S)	100
	3×10^{-3} (I)	525
Au 198	2×10^{-3} (S)	1165
	1×10^{-3} (I)	1165

* permissible daily disposal at institutional sewerage outfall

TOTAL ANNUAL DISPOSAL OF ALL ISOTOPES INTO SEWER MUST NOT EXCEED 1 CURIE PER YEAR

1/1/1979