

Duties:

1. To review and approve, or suggest revisions of proposed regulations and procedures pertaining to radiation hazard and/or contamination.
2. To review and approve proposed locations of radiation areas in regard to radiation hazard.
3. To establish regulations and conditions of a temporary nature.
4. To receive reports from the Health Physics Section and review them.
5. To review radiation incidents.
6. To recommend disciplinary action when any person using radioisotopes and other radioactive material or radiation sources fails to observe the safety rules, regulations, and procedures as set forth in this code.
7. To consider and take action on any other matters pertaining to radiation safety that are not duties of the Isotope and/or Radiation Safety Committees.
8. To keep records of the meetings of the committee in regard to all transactions considered under 1 to 7 and other matters.

Meetings:

The committee shall meet as frequently as required by circumstances, but not less than once every six months. Attendance of other appropriate persons for a specific meeting may be requested through the Director's office.

Isotope Committee Membership:

This committee will consist of at least the following members, one of whom will be appointed chairman by the Director of FRI:

1. One Radiochemist
2. One Radiobiologist
3. One Administrative Officer or his appointee
4. Head of the Health Physics Section

Duties:

The duties of this committee are:

1. To review and approve procedures for procurement of radioisotopes and proposals for use of such material in the Puerto Rico Nuclear Center. Primary consideration is given to the following:
 - a. that the person(s) requesting the material is qualified to handle and use the radioisotope(s) requested.
 - b. that suitable facilities are available to carry on the project where the radioisotope(s) is to be used.
 - c. that the proposed use of the material is safe with regard to radiation hazard.
2. To keep records of all the meetings of the committee.

Meetings:

Regular meetings shall be held every month. Special meetings may be called.

At the request of the chairman, Ti, Technical Committee and Enberchi Reactor Supervisor = chairman Health Physics Section Head UL and other scientific personnel as required.

Duties:

1. Review experiments in the reactor facilities.
2. Review changes to reactor equipment and/or procedures.
3. To review and approve in advance proposals for the use of reactor facilities.
4. Periodically review all aspects of reactor facility operations for possible hazards.
5. Submit results of reviews and recommendations to the Reactor Division Director and R.S.O.
6. Other duties as may be delegated by the Reactor Division Director.
7. To delegate such authority to the reactor supervisor as they may find appropriate.
8. To keep records of all the meetings of the committee.

Meetings: The committee shall meet as frequently as required by circumstances, but at least one meeting shall be held every six months.

IV. Radiation Safety Officer: The Head of the Health Physics Section is the Radiation Safety Officer. He is also a member of the R.S., Isotope, and Technical Committees. The Radiation Safety Officer will delegate special duties to one or more members of the Health Physics Section Staff. As head of the Health Physics Section, his responsibilities are (from the standpoint of radiation safety):

1. To review all proposed plans or projects for the use of radioactive materials and make recommendations to the person(s) submitting the plan or project or to the person using the radioactive material on the appropriate use of it.
2. To review all plans for proposed use of sources of ionizing radiation not covered in A above, such as accelerators, reactors, x-ray units, etc., and make recommendations to the experimenter for the appropriate use of such sources.
3. To review all requisitions for radioactive materials and ensure that a suitable location, storage area, etc., is available at the time of receipt.
4. To survey all incoming shipments of radioactive materials, their distribution, and storage.
5. To supply personnel monitoring instruments.

In relation to radiation safety aspects, other divisions, departments, etc., directors, heads, foremen, supervisors, etc., must keep the Health Physics Section informed of personnel assigned to duties involving possible radiation exposure in order for the section to provide the necessary personnel monitoring instruments. Other contacts of supervisors with the Health Physics Section are discussed throughout the guide.

Section II: Permissible Exposure Levels

Table 1 gives the maximum permissible exposure levels (NPE) from external sources of ionizing radiation. For the maximum permissible concentration of radioisotopes in water and air, refer to National Bureau of Standards, Handbook 69, Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure. The

levels given in Table 1 and the NBS handbook shall not be considered as tolerance levels, and efforts shall be made to keep those levels as low as possible (e.g., as close to background values as possible).

Table 1. RECOMMENDED LIMITS ON EXPOSURE TO EXTERNAL RADIATION

Exposure: NATIONAL COMMITTEE ON RADIATION PROTECTION & MEASUREMENT

PREVIOUS TO OCCUPATIONAL: Critical organs

+3 rem/week (includes the whole body, blood-forming organs, gonads, lenses of the eyes)

Skin (whole body)

16 rems/year a

30 rems/year b

10 rems/year c

30 rems/year d

(NON-OCCUPATIONAL Individuals in vicinity of controlled areas)

1.5 rem/year

0.5 rem/year (average)

General populations

0.1 rem/0-30 yrs,

10 rems/0-30 yrs (average exposure to gonads above background after age 30) from all sources

Exposure resulting

If >3 rem/week is exceeded, it is expected that modification of the NORM recommendations will result in the dropping of a medical exposure.

HAPS, Date VE. Recommendations for handling Radioactive Materials A B General Protection is best afforded in three distinct ways, or a combination of them: distance, shielding, time. It is recommended not to rush when using radioactive materials or substances, but a person should not remain exposed to radiation beyond the time required for completion of work. The use of gloves, tongs, electromagnetic holders, remote pipetting devices, shoe covers, etc., are strongly recommended. Whenever the intensity field is such that the devices above are not enough, shielding shall be used to further assure protection.

Shielding Because of the value and common use of shielding for many operations involving the use of radioactive substances or sources, certain general facts should be taken into consideration (keeping in mind that shielding problems may be very complex at times).

1. For gammas, lead (high atomic number) is the most widely used material due to its high density and relative economy.

2. For betas, plastics (low atomic number) like plexiglass and Lucite are the most widely used materials. With betas, Bremsstrahlung rays (secondary gammas) are produced. As a rule, 1 curie of beta produces about 1 millicurie of gamma equivalent.
3. For beta-gamma sources in which Bremsstrahlung phenomena occur, a combination of plastic and lead is frequently used.
4. For neutrons, paraffin and water are the most widely used absorbers and moderators.

Section IV Contamination and Decontamination

Contamination Criteria for Contamination Any group area, zone, surface, etc., exceeding the levels given in Table 2 is to be considered as contaminated.

Preventing Contamination and Spreading of Contamination All radioactive material shall be considered as a potential leaker. In handling or using radioactive materials or substances, all items which may become contaminated should be considered as such until proved otherwise by proper monitoring. This applies especially to items used in conjunction with isotopes in Class II and III.

In Table 3, glassware shall be thoroughly washed and monitored after use. "Washed glassware shall be stored separately from unused glassware. Any equipment, instrument, tool, etc., of doubtful cleanliness in regard to radioactive contamination that must be repaired shall be monitored and approved by the Health Physics Section before it can be sent for repair. The following rules shall be observed while working with or handling radioactive material: A. Avoid smoking, eating, or drinking of any kind, and use of cosmetics, etc. B. Do not use the telephone, nor handle reports, etc., while wearing gloves. C. No solution, regardless of its nature, shall be pipetted by mouth, avoiding the chance of ingestion, however remote. D. In case one has to leave the premises, be sure to wash exposed parts of the body, in particular the hands, and check with a monitor. Before leaving the premises, all protective clothing or equipment such as shoe covers, gloves, coats, masks, etc., shall be left on the premises. F. Custodians and/or supervisors are responsible for checking for radon leakage every 3 months for all radionuclide sources assigned to them or to personnel under their supervision and notifying the Health Physics Section. G. Tables, laboratory surfaces, floor surfaces, etc., which may become contaminated during an experiment or in handling radioactive material, shall be covered with appropriate paper towels, absorbent paper, etc. The Health Physics group will gladly assist in recommending materials to be used in these cases.

Placed together with mops and brooms used for cleaning "neold" areas, laboratories, offices, classrooms, and the like. Whenever a radiation area is to be vacated, the Health Physics Section shall be notified. The Section shall make a survey of the area, and if this is found to be contaminated above permissible levels, will request decontamination by the person or persons vacating the area. The Health Physics Section will give final approval for reoccupation of the area. Spills (see Appendix A for definition) shall be reported to the Health Physics Section immediately. In case of doubt as to how to proceed, contact the Health Physics Section. Spills shall be cleaned as soon as practical. If the radioactive material is in liquid form, blot with blotting paper (not towel paper) using rubber gloves. If in powder form, clean with a damp paper towel. Be sure paper is not soaked wet. Wear rubber gloves. When dry, monitor and proceed with decontamination (Part V of this section). Any glass item in a laboratory or other room where radioisotopes are present shall

never be taken to the glass blowing shop. For this reason, it is suggested that glass items (e.g., beakers, glass tubing, pipettes, test tubes, etc.) in laboratories and rooms where radioisotopes are stored or used be kept in enough quantities to meet the needs; all other glass items of no immediate use shall be stored in an appropriate place in accordance with the idea expressed above. In addition, pipettes, glassware, tubing, and similar items in a laboratory shall never be allowed to touch one's mouth. Centrifuges shall be used very carefully to avoid spills and/or contamination. They shall never be operated with the lid open, and the centrifuge tubes shall never be filled less than 1 inch from the rim when radioactive solutions are used. Note: If the contaminant is an alpha emitter, use your best judgment in monitoring. Portable alpha survey meters are not as efficient as other instruments. The Health Physics Section will take "samples" if requested.

On exposed surfaces of any kind, nor shall they be stocked in a storage room or any other area on exposed surfaces, for future decontaminations. Any item that has been cleaned and decontaminated shall be monitored to assure definite decontamination.

****Decontamination Responsibility****

It is the responsibility of individuals working with radioactive substances to get acquainted with decontamination procedures particularly suited to their work, and they shall be responsible for carrying out these procedures and taking the necessary steps to avoid the spread of contamination to other areas. It is not the responsibility of the Health Physics Section to carry out decontamination, except when the contaminated material is such that only this department has the facilities to do it, or when a serious problem of contamination may develop. In that case, this department shall be notified at once to take care of the situation. The Health Physics Section shall be consulted at any time in case of doubt to furnish advice or assistance.

****Cuts, Wounds, and Lesions****

Personnel using or working with radioactive materials who receive a cut, wound, or lesion shall report at once to the Medical Officer for diagnosis and treatment. The Medical Officer will notify the Health Physics Section. If a person is actually engaged in work using a radioactive substance that may contaminate a cut, wound, or skin lesion, proceed as follows:

1. Wash the injured area immediately with running water. Apply pressure while washing. The time factor is very important to reduce the amount of absorption of contaminants (if any were present).
2. Notify or have someone else notify the H.P.S. at once.
3. Secure medical attention as necessary. No person under any circumstances shall employ antiseptics or self-treatments. Any person receiving a cut, wound, or skin lesion should report to the Medical Officer for clearance before working or using radioactive substances again.

****Laboratory Equipment, Tools, Apparatus, Materials, etc.****

Whenever an item is to be...

Decontaminated, the person or persons in charge shall wear rubber gloves. In addition, an apron or coverall (whichever is best for the particular case) and shoe covers or rubber boots (whatever is best for the particular case) shall be worn. If fire is involved in the procedures, assault or gas masks shall be worn. Ordinarily, the majority of contaminated items can be decontaminated by the person using these items or by someone assigned to this job (not a member of the Health Physics staff). Decontamination of low contaminated items shall not be carried out in laboratories and working

areas where teaching and/or research is done as this may create a potential hazard and/or may affect background levels. All items in this group which are not going to be decontaminated immediately shall be properly and clearly labeled using a sticker, label, or tag indicating "Radioactive Contamination" until decontaminated. Such items shall be placed in a decontamination room, especially if bulky or in large numbers (e.g., part of machinery, several beakers, etc.). Wherever they are temporarily stacked, they shall be placed on top of absorbent paper or blotting paper, under water, under a hood, or in a well-exhausted room. As stated in part V of this section, subpart A, the responsibility for decontamination is taken over by the Health Physics Section only in serious cases of contamination. However, if a person is not familiar with decontamination procedures not covered in this guide, the assistance of the Health Physics group shall be requested. Also, if the physical character of the contaminated item is such that it cannot be decontaminated with conventional equipment and materials, the services of the Health Physics Section shall be requested. In case of doubt, always consult your supervisor, and if he cannot help, consult the Health Physics Section. VI. Recommendations for Decontamination. As a general rule, decontamination is a complex problem depending on the type of contaminant and the contaminated material.

Therefore, only general decontamination procedures are considered here, giving particular attention to hand and body decontamination. Table T (Appendix B) presents a list of general routine decontamination procedures; the table is to be used only as a guide. Personal decontamination in case of personal contamination follows the procedure outlined in Appendix B, which is recommended.

Section Y: Personnel Monitoring of personnel monitoring devices, all of which have a definite use for a particular type of work with radioactive material or to gather specific information regarding the exposure dose received by personnel. These devices shall be worn as indicated. Failure to do so will be detrimental mainly to the wearer.

Film badges - these badges, made of metal, plastic, or cardboard about 1.5 x 3.5 inches in size, shall be worn at all times while the person is within the controlled area (see Appendix A for definition). The badges assigned will be of three types:

1. Permanent badges - every permanent employee or person associated with or visiting PRIC for a period of one year or more will be assigned a permanent film badge.
2. Temporary badges - assigned to persons temporarily employed, associated, or visiting the Puerto Rico Nuclear Center for a period of not less than 3 months nor greater than one year (e.g., regular students, part-time employees, etc.).
3. Visitor badges - assigned to persons employed, associated, or visiting either regularly or irregularly for a period from 8 to 12 weeks.

Regardless of the type of badge, it shall be worn with the name toward the front. The badges shall be worn somewhere around the chest level, outside of all clothing. For persons engaged in special work where the hands are exposed most, wrist badges will be issued.

Badges shall be picked up every morning from a badge rack located in the main lobby. The rack is numbered serially to correspond with the film badges. Badges shall be returned to their proper place in the rack upon leaving.

Installation. The film is sensitive to a certain extent to temperature, humidity, and heat; therefore, the badges shall never be tampered with, taken home, left in the drawers, or on top of cold or hot surfaces, etc. If this is done, an erroneous reading may be recorded for the person to whom the badge was assigned. Persons employed, associated, or visiting for less than 8 weeks may or may not use pocket chambers and/or dosimeters as determined by H.P.S.

Pocket dosimeters - these are self-reading fountain pen-type electroscopes. 1. These dosimeters are assigned by the Health Physics Section to personnel working in radiation areas where the possibility exists of getting an exposure dose greater than 10 millirems of X or beta radiation in 8 hours (see table 1 Maximum Permissible Exposures to External Radiation). 2. Personnel using pocket dosimeters shall be instructed by their Supervisors on how to read them. 3. Pocket dosimeters shall never be handled roughly. Pocket dosimeters shall be picked up from the rack in the morning before starting to work. Dosimeters are placed next to the badge in the same rack used for badges, in the main lobby, in slots provided for them. Before leaving the installation, they shall be returned to the rack. Pocket dosimeters are read daily by the Health Physics Section. The section will assign 2 dosimeters to a person if there are enough available.

Pocket chambers - these devices are similar to pocket dosimeters, except they are not self-reading and have to be read in a special instrument in the Health Physics Section. Pocket chambers are assigned by the Health Physics Section to personnel working in radiation areas where the normal exposure in 8 hours is not likely to exceed 10 millirems of X or beta radiation and to visitors, since they do not wear X-ray film. 2. Pocket chambers shall be used in the same manner as pocket dosimeters and handled, picked, and returned every day as instructed for pocket dosimeters (see B 2 and 3 above). Combined.

Pocket chambers - These chambers are similar to the pocket chambers described under C above, except that in addition to being sensitive to X, beta, and gamma radiation, they also detect thermal neutrons. These chambers read in terms of millirems. These chambers will be assigned by the Health Physics Section to personnel working in areas where the possibility exists of being exposed to mixed radiation (e.g., near the reactor). Combined chambers shall be used like pocket chambers described under C above. These chambers shall be handled, picked up, and returned every day as instructed for pocket dosimeters (see 2 and 3 under 8 above). Neutron pocket chambers - these chambers are similar to those already described except that they are used to detect thermal neutrons only. These pocket chambers also read in millirems. These chambers are assigned to personnel working in areas where the possibility exists of getting an exposure of 10 millirems or more in 8 hours due to thermal neutrons. These chambers shall be handled, used, picked up, and returned as the other chambers described before.

Others - The Health Physics Section keeps a number of pocket dosimeters (self-reading) for emergency cases. There are 3 types of these dosimeters: full scale 200 mR, 5 R, and thermal neutrons.

Issuance - The Health Physics Section will issue the proper personnel monitoring instrument(s) subject to the following: 1. It is the responsibility of supervisors to notify the H.P.S. of personnel under their supervision as well as visitors. 2. This supervisor's note shall include the position (job) assigned to said personnel to facilitate issuance of the appropriate personnel monitoring instrument(s). In the case of visitors, the area or areas to be visited shall be indicated. Information

(above) should be in the hands of the Health Physics Section at least 2 days before the employee reports to work or the visitor arrives. 4. Upon receipt of notice from the supervisor, the Health Physics Section will determine and issue the appropriate monitoring instruments.

Units using radioisotopes as a source of radiation and other equipment capable of producing radiation are to be considered as sources of hazardous radiation. The hazards associated with such equipment are mostly external, and as such, Section I applies. In addition, the following regulations are to be observed:

A. Surveys

1. A survey shall be made for all energy levels at which the equipment operates.
2. A survey shall be made whenever there is a significant change in beam direction, shielding arrangement, and type of target.
3. The Health Physics Section will carry on the surveys mentioned in 1 and 2 above, but it is the responsibility of supervisors to notify the section at least 2 days in advance of proposed work to be done.

Protection

1. High radiation intensity areas around facilities using this type of equipment are considered High Radiation Areas, and regulations pertaining to such areas apply (See Section ITT-113).
 2. Interlocks, mazes, warning devices (alarm systems), etc., shall be installed in such a way as to prevent entrance into the facility while the equipment is in operation, which could result in accidental exposure.
 3. It is the responsibility of the person(s) in charge of these facilities to ensure that all safety equipment is working properly at all times and that appropriate warning signs, protective barriers, etc., are in use. The Health Physics Section, upon request, will furnish adequate warning signs, establish physical barriers, and conduct surveys whenever requested (see A-1, 2 and 3 above).
- i. Any person assigned to duties with X-ray and teletherapy units must familiarize himself with the National Bureau of Standards Handbook 60 "X-Ray Protection" and sign a statement to this effect. Only those persons signing this statement shall be authorized to work with X-ray teletherapy units.

The signed statement will be kept by the Health Physics Section.

C. Radiation Source Statement: In accordance with the regulations set in this section, part B, sub-parts 1, Form 110, 663.

Service, involving the use of radioactive substances and/or radiation sources on holidays and after hours (5:00 P.M. to 8:00 A.M. Monday through Friday) must be coordinated at least 2 days in advance with the Health Physics Section. It is the responsibility of the person(s) doing the work to ensure that appropriate personnel and area monitoring meters are available. The section will give final approval for work to be performed outside of normal hours.

Appendix A

Definition of Terms

General

In this section, a number of terms are defined from the point of view of Health Physics or Radiological Safety. These definitions are generally in complete agreement with the definitions used in other related fields, but some differ to some extent.

Definitions:

Airborne Radioactivity Area: Any room, enclosure, or operating area in which airborne radioactive materials exist in concentrations in excess of the amounts specified in NBS Handbook 69 for a 40-hour week, or in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25% of these values.

Container: Any object used for temporary or permanent containment of radioactive material, regardless of whether the container is used for protection from radiation (e.g., capsules, boxes of any kind of material, jars, beakers, cans, shipping containers, etc.).

Controlled Area (Restricted): An area under the supervision of a radiation safety officer. This implies that a controlled area is one that requires controlled access, occupancy, and working conditions for radiation protection purposes. All facilities of P.R.U.L.L.C., wherever they are located, are designated as controlled areas and are subject to the rules, regulations, and procedures given in this guide.

Critical Organ: In regard to maximum permissible exposure from external sources of ionizing radiation, the critical organs are the skin, the head and trunk, the active blood forming organs, the gonads, and the lens of the eyes. In regard to the maximum permissible concentration of a radioisotope...

In the body, in air and water, the critical organ is the organ receiving the radionuclide that results in the greatest damage to the body. Curie is the unit of activity of a radioactive substance or material. One curie is the amount of a radioactive material or substance in which 37 billion disintegrations per second occur (3.7×10^{10} d/s). One millicurie is one-thousandth of a curie ($1 \text{ mCi} = 3.7 \times 10^7$ d/s); and one microcurie is one-millionth of a curie ($1 \text{ } \mu\text{Ci} = 3.7 \times 10^6$ d/s = 2.22×10^5 d/m). Extendable clothing refers to clothing that can be disposed of right after use if necessary (e.g., shoe covers, gloves, etc.). Exposure dose (R) of X or gamma radiation at a certain place is a measure of the radiation that is based on its ability to produce ionization.

Health physicist - any member of the Health Physics Section staff qualified to carry out radiation surveys, sampling, setting up calibration facilities, waste disposal methods and facilities, etc., and all other normal duties commonly assigned to a health physicist. **Health physics surveyor** - designates a Health Physics Section member whose primary duty is surveying and monitoring in regard to radiation safety. **High radiation area** - means any area, accessible to personnel, in which the radiation levels are such that a major portion of the body could receive in any one hour a dose

of 150 millirem. Maximum permissible concentration in air and water (MPC) is a value expressed in $\mu\text{Ci}/\text{m}^3$ of air or $\mu\text{Ci}/\text{L}$ of water, to denote the maximum permissible concentration of a radioisotope in the corresponding medium. Values of MPC are given in the ICRP Handbook. Maximum permissible exposure or dose (MPE) - is a value, expressed in millirems, to denote the maximum permissible exposure to external radiation allowed to persons. MPE values shall not be considered as tolerance values, and efforts should be made to maintain radiation exposures to personnel below the recommended HP values. These values are given.

Elsewhere in this guide, Permanent Storage Area is an area solely used for the storage of radioactive material or substances. Radiation Absorbed Dose (rad) is the unit of absorbed dose (energy imparted to matter per unit mass at the place of interest). One rad is equal to 100 ergs/g of material. Radiation Area means any area accessible to personnel in which there exists radiation at such levels that a major portion of the body should receive in any one hour a dose (absorbed) in excess of 5 millirads, or in any 5 consecutive days a dose (absorbed) in excess of 150 millirads. Radiation Safety Officer is used to designate the Head of the Health Physics Section. Radiation Source - this term, although it includes radioactive substances in materials, is frequently used to designate machines or equipment that can be used as a source of radiation, like particle accelerators, X-ray diffraction machines, etc. Radiation sources are divided into three categories defined as:

Category 1: Those sources which have such low intensity that they may be handled, including for a total dose without exceeding greater than the permissible daily dose of 60 mrem.

Category 2: Those sources which can only be handled at distances greater than 10 ft, for short times (less than 30 minutes) without exceeding greater than a permissible daily dose of 60 mrem. This category includes intensities up to the maximum which can be handled outside of hot cells or other massive shields.

Category 3: Those sources of such intensity that they cannot be handled outside of hot cells or other massive shields.

Radioactive Substance, Material - any substance, material, or item which emits or produces one or more types of ionizing radiation, whether this is an inherent characteristic or not. Radioactive standards, radioisotopes, calibration sources, are examples. Relative Biological Effectiveness (RBE) is the inverse ratio of the doses of two different radiations necessary to produce the same biological effect. Roentgen (R) is the unit of exposure dose.

Sane as for (2) glassware: 20% solution ammonium citrate, organic solvents, 106 nitric or hydrochloric acid. Sane as (2) for glassware: sodium citrate 10% solution, organic solvents (turpentine), carbon tetrachloride, caustic soda or potash. Wet abrasion paint if not painted or otherwise covered, but treated for porosity; plane and collect shavings.

Quantum 1, same as for (2) glassware. 2) Radiac wash. 3) 108 solution of organic acid in weak inorganic acid. Concrete and brick: wet abrasion, chiseling, or complete removal. This in many cases is the best as paint if smooth surface. Asphalt tile: 1) Tide or other detergent and warm water. 2) Replace. Rubber tile: 1) Tide or other detergent and warm water. 2) Radiac wash. 3) Replace. Linoleum: 1) Same as for (2) glassware. 2) Carbon tetrachloride. 3) Kerosene, dilute

mineral acid. Vinyl plastic tile: 1) Tide or other detergent and warm water. 2) 10% hydrochloric or nitric acid. 3) 20% hydrochloric or nitric acid: replace. Ceramic tile: 2) Mineral acids. 2) Ammonium citrate or trisodium phosphate.

Dust spills: Contact Health Physics Department since this requires a vacuum cleaner. Note: 1) If contamination is due to an alpha emitter and decontamination to the acceptable limits cannot be accomplished, but is very close to it, if of short half-life, set apart until contamination is within limits; if of long half-life, coat with shellac, varnish, or paint if possible, in case of valuable equipment. Inorganic acids should be used with caution. Acid fumes may be toxic to personnel and there is also the possibility of corrosion. Organic solvents should be used with great caution as many are toxic and flammable.

APPENDIX B: Personal Decontamination

1. Check contaminated area(s) with a survey meter.
2. Wash thoroughly contaminated area(s) with warm water and Tide, or similar detergent for about 2-3 minutes, working a good lather. Dry well with a paper towel. Check contamination again. If it has been reduced, repeat step 2.

three or four times as long as there is a reduction in contamination counts until this falls below the maximum permissible contamination level. If after two consecutive washings counts remain the same without reaching the tolerance level, proceed with step 3.

3. Repeat step 2 using a hand surgical brush, being careful not to apply excess pressure so that the bristles scratch the skin. Repeat step 1. Do not wash more than three times, 2 minutes each. If no results, proceed with step 1 or base wash. Moisten your hands and apply citric acid crystals. Rub for about 3 minutes. Repeat step 1 again. If not successful, try hand wash. If contamination is known to be due to fission products, use titanium dioxide in step 1 instead of citric acid.

However, T.D. has proved good for other contaminants besides fission products. Add enough T.D. in the palm of your hands to form a paste. Work this paste well over contaminated area(s), but be sure to prevent hardening of the paste by adding water sparingly for about 2 minutes. Rinse thoroughly with warm water, then use water and Tide and scrub with a surgical brush assuring that no paste remains under and around fingernails or it will form a hard cake which is difficult to remove.

Repeat step 1. If step 1 or 1a fails to reduce contamination below tolerance level, proceed with step 5. Apply potassium permanganate (10%) - sulfuric acid solution. Freshly made solution of equal volumes of a saturated potassium permanganate solution and 1% (or 0.2%) sulfuric acid solution and scrub with a brush for NOT more than 2 minutes. Rinse thoroughly with warm water. Repeat step 1. (Exposure to the solution for more than 2 minutes may remove a layer of skin). Step 5 can be repeated up to 3 times. If and when decontamination is satisfactory, proceed with (b) wash hands thoroughly with a freshly made 3% sodium bisulfite solution to remove the permanganate stains. Wash with Tide and warm water. Dry well with a paper towel.

If all the methods described fail to decontaminate,

Proceed with step 1. Apply lanolin or an equivalent hand cream to contaminated areas to soften dirt.

Notes: Apply solutions to the neck, ears, and face with absorbent cotton. Keep two graduate 100 cc bottles, one with a saturated solution of potassium permanganate and the other with the 1% sulfuric acid solution. Keep several 10 gram packets of sodium acid sulfite to dissolve in 200 cc of water.

4 Reminders: Used paper towels and brushes, if discarded, shall be dumped in the dry radioactive waste can. Contaminated clothing shall be placed in a paper bag and dumped in the corresponding hamper, but if the clothing is very wet, place it in a plastic bag first. Do not use oxalic acid or organic solvents for decontamination. Before starting decontamination, if this is very low (as indicated by monitoring), you may carry on decontamination without any help. Keep calm all the time. Avoid spreading contaminants by grasping detergent containers, solution bottles, etc., with a paper towel. If help is required, whoever assists in decontamination shall wear rubber gloves.