

PRIC = 6 (Health Physics) 'PROCEDURES MANUAL FOR PERSONNEL MONITORING Prepared by J. A. Ferrer Monge P. Cruz González William H. Soderstrom Health Physics Division Puerto Rico Nuclear Center operated by University of Puerto Rico U.S. Atomic Energy Commission Mayaguez, P. R. ---Page Break--- CONTENTS Authorization Introduction Section I Personnel Monitoring Devices, Description and Use Section II Procedures and Criteria for the Assignment of Personal Monitoring Devices, Section III Procedures for the Distribution, Reading and Collecting of Monitoring Devices Section IV Records Section V Exposure Reports Section VI Permissible Occupational Levels of Exposure to External Sources of Radiation ---Page Break--- PUERTO RICO NUCLEAR CENTER Operated by UNIVERSITY OF PUERTO RICO for U.S. ATOMIC ENERGY COMMISSION Authorization 'This Procedures Manual for Personnel Monitoring has been reviewed and approved by the Safety Committee. It is hereby approved and under operative as of April 30, 1964. C. Rengher, Director ---Page Break--- 'PROCEDURES MANUAL FOR PERSONNEL MONITORING INTRODUCTION In all installations where external or internal exposure to radiation may occur as a result of handling or using radioactive materials and sources of radiation, a Radiation Safety or Health Physics Group is organized. One of the functions of this group is the safeguard of personnel, the calculation of radiation exposures, record keeping of such exposures, and counseling as to the best methods for protection from radiation. In personnel monitoring, several devices or instruments are used, of which the most practical ones are the pocket-type ionization chamber and film badges. The procedures and techniques presented in the following pages have two purposes: to provide standard techniques on personnel monitoring resulting in reliable records of personal exposure and to provide instruction for new employees as well as training for participants in various programs offered by the Puerto Rico Nuclear Center.

Break--- 1-01 SBCTLOH T 1 Personnel Monitoring Devices, Description and Use. There are a number of personnel monitoring devices, all of which have a definite use for a particular type of work with radioactive material, with the purpose of gathering information in regard to exposure dose received by personnel. These devices shall be worn as indicated. Failure to do so will be detrimental mainly to the wearer. A. Film badges - these badges, made of plastic about 2 2/4 x 1 3/4 inches in size, have a beta-gamma film only or a beta-gamma film and a neutron film depending on the need. 1. Types - three types of badges will be assigned. a. Permanent badges - these have a picture of the person to whom it is assigned in the front, with the badge number at the top of the picture. The serial number is preceded by a set of capital letters indicating the area where the badge is used and its permanent status. The following set of letters has been assigned so far: 1) WP - Mayaguez permanent badge 2) RP - Rio Piedras permanent badge b. Temporary badges - these are similar to permanent badges but they do not have a picture of the wearer. Instead, the name of the person is typed on a white cardboard front with the badge number at the top. The serial number is preceded by a set of capital letters indicating the area where the badge is used and its temporary status. The following set of letters has been assigned so far: 1) ME - Mayaguez temporary badge 2) RE - Rio Piedras temporary badge 3) OP - Cancer Hospital temporary badge Note: The badges have been assigned to Cancer Hospital employees to differentiate them from the PRNC employees which are either FP for Rio Piedras. Although the badge bears letters suggesting temporary status, it is meant merely to provide identification regardless of their permanent or temporary status in the institution for which they work. C. Short-term badges - these badges have a yellow cardboard front with the serial number typed at the top. This number is preceded by a set of capital letters indicating the area.

where the badge 39 used its short-term status. The following set of letters has been assigned 90 Zar: a) MB ~ Mayaguez short-term badge b) RS = Rio Piedras short-term badge ---Page Break--- 2

6 t 1-02 Due to the diversity of facilities in PRIC, a color coding scheme is used for safety and operational purposes. Badges will have a red, yellow, or green stripe in the bottom front depending on the wearer's duties and needs. Regardless of the type of badge, this shall be worn with the serial number towards the front. The badges shall be worn concisely between the chest and waist level outside of all clothing. Permanent and temporary badges shall be picked up from a badge rack located in the main lobby when entering the installation. The rack is numbered serially to correspond with the film badges. Badges shall be returned to their proper place in the rack upon leaving the installation. Short-term badges are supplied by the receptionist and in special cases, by the Health Physics Division directly. Upon leaving the installation, the wearer shall return the badge to the receptionist or to the rack if he is staying more than one day. Besides radiation, films are sensitive to a certain extent to humidity and changes in temperature; therefore, the badges shall never be tampered with, taken home, left in the drawers, near radiation sources, 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. B. Pocket dosimeters - these are self-reading pen type electroscopes. These will be used by personnel working in radiation areas where the possibility exists of getting an exposure dose greater than 60 millirems of X or beta-gamma radiation in 6 hours (See Table T for Maximum Permissible Exposures to External Radiation). Pocket dosimeters shall be placed in boxes clearly marked "Dosimeters." Such boxes shall be located in the: a) Lobby dosimeter rack (Mayaguez and San Juan) b) Reactor building main entrance door c) Amex building bat personnel using

Pocket dosimeters shall be instructed by their supervisor on how to read them and when to use them. Whenever such a dosimeter is to be used, the person interested should pick one from the box, write down in a slip of paper provided for, the Tuli name, number of dosimeter, initial reading of dosimeter, and date. When using the dosimeter, the wearer shall record its final reading in the slip of paper, attach the slip to the dosimeter, clip, and return both to its appropriate place. If the dosimeter's reading is off-scale, notify the Health Physics Division immediately. In case a dosimeter is to be used for more than one day, the wearer should return it to its corresponding place in the rack.

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1-05

Table I. RECOMMENDED LIMITS OF OCCUPATIONAL EXPOSURE TO EXTERNAL SOURCE RADIATION EXPOSURE

10 corporate use (54) whole body, head and accumulated dose 9 (w= 18) trunk, blood-forming organs, gonads, lens 5 weeks (quarterly) 3 Skin of total body year 30 and thyroid 15 weeks (quarterly) 10 Extremities year 18 weeks (quarterly) 2 #1 is the age and greater than 18. Revised: January 2, 1965

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Pocket dosimeters shall never be handled roughly or left near a source of radiation. Pocket chambers - these devices are similar to pocket dosimeters, except they are not self-reading and have to be read with a special instrument. These will be used by personnel working in radiation areas where the possibility exists of receiving a dose greater than 20 millirem of gamma or

beta-gamma radiation in 8 hours. Pocket chambers shall be used and handled in the same manner as pocket dosimeters.

D. Others

1. The HPD keeps a number of high-range pocket dosimeters for emergency use.
2. Use of audible alarms is required for the operation of certain radiation facilities such as the game room and reactor facilities. Specific instructions on their use are given in the operating procedure of the facility.

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Section 22

Tron Procedures and Criteria for the Assignment of Personal Monitoring Devices

TEL Procedure on arrival to PANG Ae Hew Personnel. The receptionist will instruct new employees reporting to work for the first time to contact KPD before they are admitted to work. 2. Health Physics will proceed as follows: a) Request two photographs (2 X 2 inches) from the Administration of new employers sized for a period of no less than one calendar year. b) Fill Form PRC HED (Pi) 602. The division hiring the person will supply the information called for in this form. c) Fill in a reference blue card (Figure 2) for every person for whom Form PRUC-HPD (Fi) 602 is completed. If the person's stay is for more than six months, two cards, a white and a pink one, will be issued, in addition to the blue one. The blue card will be kept in alphabetical order in a file in the HPD Director's office, the pink and white ones in a file in the Record Keeper's office. The white card will be filed by name, while the pink one will be filed by badge number. If a person terminates, the pink card can be discarded. The white and blue ones are clipped together and placed in a file drawer headed "terminate" in the HPD Director's Office. 1. Instructions for setting up reference cards: a) Type badge number. b) Type name of person. c) Type division (actor, Health Physics, Radioisotopes Application, etc.) d) Type PME, PMO, and termination date. PME is the date when the person shall start wearing the film badge. PMO is the date when the person stops wearing the film badge or never. Termination date is when the person terminates. e) Issue a provisional badge or pocket number until the final badge is assigned, if one is needed. The case a final badge is assigned, its purpose shall be explained to the person. ---Page Break---

08 PUERTO RICO NUCLEAR CENTER Notice of Arrival and Departure TO BE FILLED BY SUPERVISOR Expected Date of Position Division Arrival and Departure. Supervisor Date. If no MT or Mite was checked, write under the line. If MT is needed, put a check mark under TAT and MI and

write film badge number assigned next to FAI. "Do the same for pocket meters. ORM PRICE-EFD (74) 602 ---Page Break---

1-05 wp-con John Doe Health Physics ma "0 a Termination date Fig. 1 B. students 1. 'the receptionist will refer students to the HPD where Form 662 will be filled and the type of badge to be worn determined. 2. Health Physics will proceed with steps ϕ and @ of IT.1, A, 2 above. ©. Visitors ALL visitors shall be interviewed by the receptionist who will decide which type of monitoring device is necessary. In case of doubt, the receptionist will contact EPD. IL. 2 Criteria for Issuance of Personal Monitoring Devices A. Film Badges 2 ALL persons associated with PRNC shall wear a film badge. 'The following badges will be issued depending on their association with PRC. B. Permanent badges - are assigned to permanent employees or persons associated with PRIC for a relatively long period of time (one year or more). Permanent badge number shall be assigned to a person for life. It shall never be reassigned to any other person. C. Temporary

badges - are assigned to employees or persons associated with PRIC for a period less than one year, but more than six months. Part-time employees and full-time PRC students are also assigned temporary badges. This badge can be reassigned. C. Short-term badges - are assigned to employees or persons associated for a short time (six months or less) with PRNC. They are also assigned to PRNC San Juan area personnel visiting or temporarily engaged at the Mayaguez area and vice versa. Students attending classes at PRKC (other than full-time PRC students) also fall in this category. This badge can be reassigned. ---Page Break--- II. Criteria for Color Coding 1. Red - persons wearing a badge with a red stripe have access to all facilities within PRIC. Assignment of red badges will be done after consulting with the Reactor Division Head. 2. Yellow - persons wearing a badge with a yellow stripe have access to any facility within PRIC except the Reactor Building, which they

can visit provided they are escorted by a person wearing a red striped badge or by previously notifying the reactor supervisor and getting his approval. 3+ Green = persons wearing a badge with « green stripe have access to all facilities of PRIC except Reactor Building, laboratories and federation areas in general which they can visit, provided they are escorted by a person wearing a red or yellow striped badge according to the area visited, or receiving approval from the person working in the area. 1B. Pocket Chambers The receptionist will give pocket chambers to individual visitors to offices within a laboratory or visiting an area where they may be exposed. Prior approval must be had from the person to be visited. 2. Employees of service companies (typewriter, telephone, electricity, etc.) after due identification. However, the Division Head shall request a film badge or pocket dosimeter from HD if this work is to be performed in an area where the serviceman may be exposed to ionizing radiation. 3. One out of every 5 persons of touring group: C. Pocket Dosimeters will be used by personnel as described in Section 1.1 B. D. others 1. The HPD keeps a number of high range pocket dosimeters for emergency use. 2. Use of audible alarms is required for the operation of certain irradiation facilities such as the gamma room and reactor facilities. Specific instructions on their use are given in the operating procedure of the facility. ---Page Break--- I-05 1.5 Notification to Interested Person upon completion of reference cans and assignment of proper personnel monitoring device the HPD technician in charge of personnel monitoring will notify the interested person using Form PRIC-HPD (PM) 6028. Effective you have been assigned FM No. FM No. which is located in the rack in the Lobby. {FORM PRICED (Pu) 602 ---Page Break--- II-o. SECTION III Procedures for the Distribution, Reading and Collection of Monitoring Devices TII-1 Pocket Meters A Distribution - pocket chambers and dosimeters are distributed as follows 1. Dosimeters used

by personnel are routinely charged and distributed weekly, according to section I.3. The slips of paper referred to in Section T.2, B.4-5 with the readings will be collected daily. This will determine if a dosimeter needs to be charged more frequently. Pocket chambers assigned to visitors are read, charged and returned daily to their assigned place in the receptionist's desk. Reading of meters 1. Meter number is recorded in Dews. (For 600) 2. For pocket chambers, the reading is recorded in the DOWS before removing meter from charger reader. When dealing with pocket dosimeters, the reading is transferred daily from the slip of paper to the DOWS. ---Page Break--- more PUERTO RICO NUCLEAR CENTER PERSONNEL, MONITORING DAILY DOSIMETER AND CHAMBER WORK Distributed by collected by pave Recorded by, Ta roe Ties Pane (current) | (referent) | rest Remarks [FOR FRAC-HPD (7%) 600 ---Page Break--- TIT-03 Rejects a. Meters reading more than 30 mrem in one 8 hr. day shall be placed in a box marked "Examine". b. The meter number is entered in the IOVS. Under the corresponding column, record the exposure dose followed by the letter (B) or write (08) if the meter reads off-scale. Mechanical and leak tests are carried out on the

meters and the results are recorded under the column "TUSY" of DCW3) My L = OK shows satisfactory results on both tests, N. referring to mechanics' dosage test and L to leak test. "If one of the tests fails, then an X is written after the identifying letter (Meter 1), for example, L - OK, M- X means leak test unsatisfactory, and mechanical damage of the meter. 4. If both tests are satisfactory the meter reading previously recorded will be accepted. In the case of a meter reading off-scale an investigation is started to determine the reason for such a high reading (e.g. the meter was left inadvertently near a radiation source). Use Form 601. If one of both tests shows the meter is beyond repair discard at . Procedures for Off-Scale Readings Whenever an investigation for the off-scale reading indicates

that 'a person received more than 200 mR or mrem, the film in the badge shall be removed and processed immediately. The film exposure reading will be entered in column 3 or 4 of DOWS making a note under remarks that such exposure is due to film dosimeter. D. Miscellaneous Keep the form DOWS until final results have been obtained and recorded in "Kardex" cards or Short-Term records (see next section). IL-2 Film Badges As Collection and Processing a 'Permanent and temporary badges issued, are assigned a place in the rack at the lobby of the building, where they will be kept when not in use. The film shall be collected and processed routinely as follows: (1) Neutron film (2) twice a month - for personnel that can be exposed to neutrons routinely. ---Page Break--- a ql-ot PUERTO RICO NUCLEAR CENTER Personnel Exposure questionnaire Information 'This report shall be made only after a pocket chamber or pocket dosimeter reading has been tested for leakage and mechanical damage and found in good working condition. Meter No. Identification No. Date when meter read 05 Base Division last, First, Taaaie} Mechanical damage test satisfactory (yes or no) Leakage test satisfactory, (yes or no) Pins density equivalent to, pens of radiation. Neutron tracks equivalent to, rem of neutrons. TED to date when meter read 0\$ (TCD dose obtained from Kardex Records or Short-Term Records) Estimated exposure dose Person (s) working in the same area where possible overexposure occurred and meter readings. one A No. || [Iti [| | ---Page Break--- mo.) rr rrr ee — Description of work performed by person during the day when meter 'was found 0S. Description of work performed by another person or persons in the same area or nearby area where possible overexposure occurred. 'Action taken upon disclosure of possible overexposure. Te en Investigation Report of Radiation Exposure in process? yes or no Ress Investigated by. Date approved by. Head, Health Division 'FORM PRIC-HPD(Ft) 601 ---Page Break--- I-06 (2) once every three months (quarterly) -

for personnel whose duties routinely do not imply exposure to Beta-gamma film (2) once a month = for personnel that can be exposed to these radiations routinely. (2) once every three months (quarterly) - for personnel whose duties routinely do not imply exposure to these radiations. 2 Short term badges - shall be assigned a place in the rack only when the Worker visits PRIC for more than one day, otherwise, they will be returned to the receptionist. The films shall be collected the same day the person leaves PRNC and are processed together with films of permanent and temporary badges. WOE: In special cases films can be processed at an interval other than indicated above. Bs Schedule of Film Processing The procedure outlined below is to be followed: 1. ALL films will be processed within 2 days after change date except when this comes on a Friday. In this case wait until the first working day in the next week. 2. ALL films not processed at this time will be designated "not received." 3. If film appears later it will be developed with the next batch. 4. If at the end of this second period the film has not been found, record in appropriate form as film lost. ---Page Break--- Ww. rv-01 SECTION IV Records two types of records will be kept: "Kardex" and Short-Term Personnel Exposure record "Kardex" records will be kept only for persons employed, associated or visiting for a period of not less than 6 months. For other persons, exposure records

are kept in a different system called Short-Term Personnel Exposure Records. "Kardex" Record Cards - Description A. The "Kardex" record consists of two "Kardex" cards designated Card J. (see figure 2) and Card B (see figure 3). Cards A and B are printed on both sides and provide record space up to 26 weeks or two quarters each. B. Card A is used to record exposure as obtained from the reading of pocket meters only, while Card B is used to record exposure as obtained from the reading of badge film as well as pocket meter. In the lower left-hand corner of Card B on both sides shall be

written the name of the person whose records are to be kept. Next, the division to which the person belongs. Then, the fin badge number. o. Transfer of Exposure Reading to "Kardex" cards 421 exposure entries shall be made in pencil. Other entries in ink. No erasures are allowed. If a mistake is made in an entry, cross out such entry, enter the correct one and initial the correction. Since "Kardex" cards are filed in numerical order and pocket meters and film badges are read also in numerical order: 1. Find card number corresponding to first meter number listed in the Daily Document and Chamber Work sheet (DOWS). Now make the appropriate transfer from DOWS to card and cross out meter number in DOWS. Complete ALL necessary entries in one card before proceeding to the next one. 3. Repeat step 2 until all meter numbers in DOWS have been crossed out. 4. Always pull out drawers in order and work with one drawer at a time only. D. Specific Procedure 1. cant ---Page Break--- NW rel TT MAAAAAY TT] NV MN Figs entry PRYSES Jewn Doe 2 cor ---Page Break--- 2v-09 fa. First column WK in Kardex card refers to Health Physics week. HP week No. 1 always starts on January 1st of each year. b. Write MI (meter issued) and date on side of card A corresponding to date of issuance as illustrated in Figure 4. The subscript denotes type of radiation meter issued, thus My means actor for X or gamma radiation. c. The second column "Days" is subdivided into seven sub-columns, one for each day of the week. 4. Each week is divided into two sections, by a horizontal line. Each day in any week is divided into four sections by two diagonal lines since two types of meters may be used in certain cases, one for X and/or gamma radiation and another for thermal neutron radiation. The following Figure illustrates how the sections, which are numbered 1 to 8, are filled. 2) Enter daily exposure due to X and/or gamma radiation in this space. 2) Enter daily exposure due to thermal neutrons in this space. 3) Enter the sum of 1 for the day plus 3 of previous.

day. 8) Enter 2 for the day plus 4 of previous day. 5) Enter sum total of 1 for the whole week. 6) Enter sum total of 2 for the whole week. 7) Enter total of 7 of previous week plus 5 of present week except as noted below. 8) Enter total of 8 of previous week plus 6 of present week except as noted below. Note: 8 and 8 will be equal to 9 and 6 respectively only for the first week an entry is made. Figure 9 illustrates an exposure record with entries for the first 15 weeks. Whenever an irregularity occurs it shall be indicated in the last column "IRR" and dated. The following shall be considered irregularities: ---Page Break--- ERANAAAAM KANN " RRR PAA PARAS PANSY SRARAKNIS PASS CANAAN R SAN AAAS RI PANS ---Page Break--- Note: 1- Meter contaminated 2 Meter damaged 3 Meter lost Whenever a meter is taken out of service, type below ME, MO and date. The same procedures will be used when a meter is reissued. (See Figure 5) 6: The last column to the right of the card will be used to accumulate any thirteen consecutive weeks. The weeks covered will be written on top of the accumulated exposure dose as shown in Fig. 5 for the first consecutive thirteen weeks. 2. Card B 4 Write Mi (film meter issued) and date at bottom of Card B #5 illustrated in Figure 6. >. First column "WIC" in Kardex cards refers to Health Physics week. The second column (Film Badge) subdivided into six subcolumns, the three columns following, are all numbered in Figure 6. An explanation of each one follows. 1. Enter open window density. 2. Enter open window dose (mrem equivalent of density). 3. Enter shielded window density. 4. Enter shielded

window dose (mrem equivalent of density). 5. Enter total of 5 of previous entry plus 2 of current entry except as noted below. 6. Enter total of 6 of previous entry plus 8 of current entry except as noted below. 7. Enter current fast neutron dose (mrem). 8. Enter total of 8 of previous entry plus 7 of current entry except as noted below. Note: 2 and 5, and 6, and 7 and 8 will be equal in the first entry.

mie: 9+ Enter in this space the value for TSR, from card A for the corresponding week. See part E of this section. 20. Enter the sum of 6 plus 6 for the corresponding week. ---Page Break--- VV) EV " | Le | te a) | | LIV | Se eee eee | 4 | - TTT Va fet tol TT Pld) [TI [il | | | a [Ba BECEEZE Vee "a sEHEHEEH EH "a ---Page Break--- a Enter irregularities if any. The following will be considered as 20. code 1 film fogged 2. film contaminated 3. film damaged - film missing - film damaged in process 4. 5 6. film lost in process 7. evidence of X-ray exposure a - evidence of light exposure FUL - film meter lost MM - film meter not processed Whenever a film badge is taken out of service, write at the bottom of card B, under FMI, PMO and date. If the badge is reissued follow the same procedure (see figure 6). Notice from figure 7: 1. That in this example in weeks 1, 2 and 3 no entries were made under OY, OU, SH, SVD and OND assuming film for beta, X and/or gamma radiation was processed normally every four weeks. 2. Similarly, every two weeks one entry was made for FX (fast neutron dose) since the film was processed every two weeks. 3. SuD represents the dose due to penetrating radiation. This is the one of most interest. A. Beta dose is not recorded directly in the exposure record. However, this can be calculated at any time from the OW and SH densities: Exposure records are based on personnel monitoring film except as provided below. If film is lost or damaged such that it is not usable for determining the exposure, then readings from meters will be used provided these readings cover the same period of time as the film. This implies that the person was using a meter plus a badge simultaneously. ---Page Break--- Ww 3 1-08 2. If the film is lost or damaged such that it is not usable for determining the exposure and no meter reading is available as provided in 1 above, then the exposure from the previous monitoring period will be used to prorate the exposure for the current period up to the time a new film was issued. Short-term records -

are kept for persons associated with PRIC for periods of less than 6 months other than one-time visitors. Records shall be kept in Form 603. Film from SP badges is processed in accordance with Section TIT.2; however, the exposure dose is not measured and recorded unless there is reason to suspect that the exposure may be significant, which is determined by the type of work performed by the individual. ---Page Break--- PUERTO RICO MUCLAAR CENTER SHORT TERM PERSONAL EXPOSURE RECORD PDE DATE location | pose REMARKS, [If no FD, WD or FO was used indicate none. Under location enter: visiting reactor, or person, etc. FORM PRNC-HPD(PA)G03 ---Page Break--- SECTION V Exposure Reports A report of whole body exposure to external penetrating radiation shall be submitted by the HPD to PRIC's Director, Associate Directors, and Heads of Divisions, using Form 603 in accordance with 11.2, a, La-b Ve2 An exposure report will be sent to institutions to which service is given whenever films are developed. V.3 An annual summary report of whole body radiation exposure to external penetrating radiation accumulated during the year shall be submitted in duplicate to the Area Manager using Form AEC 190. Similar reports are submitted to PANG Director and Associate Directors in Form PRIC 604. V.b An annual summary report of internal body exposure from deposition of radioactive material during the year shall be submitted to the Area Manager using Form AEC 191. Similar reports to PRIC Director and Associate Directors are submitted in Form PRIC 604. Whenever an external exposure greater than 25 rem occurs, the Director should be informed immediately by telephone. A. If the incident occurs outside of working hours, San Juan area personnel are to telephone the Director and Associate

Director (San Juan area), and Mayaguez area personnel are to telephone the Deputy Director and Associate Director (Mayaguez area). B. Start an investigation of the incident and submit an Investigation Report of Radiation Exposure. Send four copies to AEC Area.

Manager, one copy to PRIC Director and Associate Directors and one to HPD Head. Use Form PRIC-HPD (PM) 6030 for this report. V.6 Whenever an external exposure, as determined from badge film, exceeds 3 rem in any 15 consecutive weeks, start an investigation using Form 6040 in quintuplicate. Send three copies to PRIC Director and two copies to HPD Head. The director will send one copy each to the associate director and division head concerned. See ABC Manual Appendix 902, April 4, 1962 and Chapter OR-0502 and OR Appendix 090, November 9, 1962 for classification of accidents and reporting instructions in detail. ---Page Break--- V.02 PUERTO RICO NUCLEAR CENTER Monthly Report of Whole Body Radiation Exposure to External Penetrating Radiation Division Month, Send Report to: Division Year Same Total Three Badge No. Current Yearly Month Cumulative Counts FORM PRIO-FED (PA) 6030 MPD, Personnel Monitoring Supervisor Date ---Page Break--- I OG rex zon spsoom WEY 430Np WOES TO/pHE (q_pEED) spODKEL ,XOPI, WoLy pauTOAgO AID saKop War SOF BOFAGUO O90 Teer | | 4 { | ars ar-mfr-orf or-6] Gal etl asf os] caf re] ce] et] to "eSBaE FUPROTIOS BT Jo GUS UT SsSop WAY PSTETRUTOGS PSyMATTES Jo "OH ann gon a0 8g tr rparanog 19x Aq posedoxg +4q gouzane Apoq ong typ a0 av po.msvoyt sperodsag 2700 reak otf Dupre poywTrumosy worsUTPRY Suproxqouey TMS 0g amsodxa uoraorped Apor stou Jo Areumg 220d TonuNy 'WSINED HVETONN OOTS ODN ---Page Break--- veoh ro9 (lk)aaE-OnE = seuoyssodep pagtodas AtsnopAasd coy To0> YUE ONT UF LxqH9 9uO SUD paytOdod vol 203 "By pax WT aque 9u0 = 19aL0;UF Jo adozosT YOR JO; AxqUD eTANOD v OxWE GO Wah pIDDGS MOR :e9IEH oo i HA 4 EEE = { Ta eee eae sem zfts pea eft > aaa = GESUTUT Jo MoTwEF Fos MUOTA Feedap FhOq JO OT -----Perraim e oy st 09 8020 ayehtme TeoTEsD iq uorsmREleRoG ---Page Break--- Le a a 2 B PUERTO RICO MUCLEAR GEYTER Operated by University Of Puerto Rico For U.S. ATOMIC ENERGY Commission College Station Mayaguon, Pe Re Tsao" sEpoRE ADDAPION ELEOSURE bato Kane ity Tine Waite one Address Date of Birth 5.

Place Sex Te 8.8. Yow 8. Occupation (at time of exposure) Employer's Name & Address Other individuals exposed? (If yes, list under item 2h and use an additional form for each one). Any animals exposed? (If yes, report on a separate sheet and attach to this report). External exposure Internal exposure (check) External estimated total exposure (rem) Procedure for converting units of measurement to rem: at survey meter reading in r times RBE of ___ for radiation bi density of Film in terms of r times RBE of for _radiation neutron tracks/en equals one 8 ---Page Break--- 49+ Isotope (s) derived, 16. Internal estimated total deposition (microcuries) Af. Estimated fraction of P.C. deposited in organ (s) of interest, (microcuries) 3B. Biological criteria OF procedure used to estimate deposition including instrumentation. at air sampling. Instrument or Bioassay Instrument or other 19. Method of transportation and probable mode of entry into the body. gaseous effluent, ingestion or/and inhalation (underline) aqueous effluent, ingestion or/and inhalation (underline). airborne particles, ingestion or/and inhalation (underline). other 20. Date(s) covering period in which exposure occurred 21. Description of events leading up to and including occurrence of exposure. 22. Role played by person(s). 23. Suggestions for preventing similar incidents. 24. Names of other person(s) exposed. (see item 10) 25. PRC Insurance Company 4: Company has been notified 7 Submitted by Wealth Physics Division Approved by PREC Safety Committee FORM PRINTED (F) 60M ---Page Break--- wt v8 v9 vor Whenever an unplanned release of radioactive material in concentrations which, if averaged over a period of 24 hours would exceed 5000 times the Limits for that material specified in appendix 5, table IT, 10 CFR 20 or if the release is offsite and may cause

the general population to receive an exposure greater than the values set forth in the Radiation Protection Guide for Federal Agencies, the Director shall be notified immediately by telephone, A, Start

an investigation of incident and omit an Investigation Report of Radiation Exposure. Distribution will be the same as for §.3 above. The HPD will determine the action to be taken in case a person(s) exceeds the MPE in order to bring the cumulative exposure total within the established limits. These are discussed fully in Section 6. A. The Radiation Safety Officer will notify in writing the supervisor concerned. One copy will be sent to PRNC's Director. PRNC will notify any person receiving an overexposure (see Section VI-1) of the nature and extent of exposure. Such notice shall be in writing in accordance with CFR Section 20. 50 (b). See ABC Appendix 0302, annex 2. ---Page Break--- vE-08 sector for Permissible Occupational Levels of Exposure to External Sources of Radiation VI-1 Beginning with 1958 and thereafter, the maximum permissible accumulated exposure dose, MPB, in rems at any age, is equal to 5 times the number of years beyond age 18. A. To calculate MPE to critical organs (whole body, gonads, blood-forming organs, lens of the eye) the MPE = 5 (age - 18) rem. For age = 30 MPE = 5(30-18) = 60 rem. In any one year a maximum of 12 rems is allowed, provided the average of 5 rems/year is not violated. The MPE allowed to the skin of the whole body (non-penetrating radiation) is 30 rems per year. The MPE to the extremities is 75 rem/year. B. The MPE for one quarter (13 weeks) is 3 rem averaged over a period of 15 weeks. P. The MPE for one week (40 hours) is 0.3 rems. This is an administrative value. G. The MPE for 1 day (8 hours) is 0.06 rems. This is an administrative value. Likewise for administrative purposes the MPE per hour is 769 microrems. Addendum of April 15, 1958 to WBS Handbook 59, Permissible Dose from External Sources of Ionizing Radiation, This is the basic equation in determining permissible exposure levels. Addendum of April 15, 1958 to HES Handbook 59, Permissible Dose from External Sources of Ionizing Radiation, Section 7, page (6). In this case 12 rems/yr may be

allowed under certain circumstances. 'The age at which a person will reach his age prorated will be obtained by $x = \frac{1}{2}(age + 18)$. 238). ---Page Break--- V2. In calculating MPE accumulated using MPE - 5(1%18) previous exposure shall be taken into consideration, If Whenever a previous radiation exposure record exists, this shall be used in calculating MPE accumulated at age I. This will allow a person to use his reserve exposure as explained under VI IB, (See footnote ##* on previous page) B. Whenever a previous radiation exposure record is not available, assume that the MPE beyond 18 years of age has been accumulated. C. To the effect of making the calculations required under VI-2h or VI-28, an Occupational Radiation Exposure History (Form PRNC-HFD (ey) 604d) shall be filed with the Health Physics Division not later than two weeks after employment, provided such person is expected to be employed, associated, or visiting for a period not less than six months consecutively (See subsection IV.) An individual folder will be used to keep all exposure records, reports, etc., for each person with a "Kardex" record. The front and back covers are printed as shown in Figures 8 and 9. B. On the front cover of the Folder is printed an exposure record graph. The record graph is prepared and read as follows (see figure 8): 1. Draw (using black ink) a line from a point in the abscissa - Age in Years (A) - at which the person starts working to a point corresponding to the same age in the right ordinate - Age in Years (R). Read in the left ordinate the accumulated dose to any age up to 65 assuming that the 5 rem per year exposure limit is not exceeded. In the example illustrated, the person started to work at age 35, therefore at 65 years of age the MPE accumulated is 150 rems. ---Page Break--- TITTTT HEE ' qaEEreaeee L A os of F HEPES if & £€ g& 8 z a a 5 MG SCC ---Page Break--- Vi-05 2. At the end of each year the cumulated dose is entered in the summary record, Form 605, and plotted in red ink in the record

graph. If the individual

email dose rate (for the period since 'the person started working) does not exceed 5 rem per year, the red line should fall under the black line. In case the red line is observed to approach the black line, corrective measures should be taken. The total cumulative dose for an individual is always given by 5 (128) with an allowable maximum of 12 rems in one year, the black line indicating when 5 rem per year average is exceeded during the period covered since starting to work. 3. On the back cover of the folder is printed a table (For PRIC-HPD (BO Goke) indicating all the records of the person in regard to radiation safety. Space is provided for at least 20 year records. The columns shall be filled as follows: (2) "Wardex" record. This column shall be filled twice a year (July and January). (2) Cumulative summary. This column shall be filled twice a year (July & January). (3) 42 others as needed (see instructions in the folder). ---Page Break---

PUERTO RICO
NUCLEAR CENTER SUMMARY OF RADIATION EXPOSURE RECORDS None Division Date The
radiation exposure records of the Health Physics Division show that the above-named person
received, during the time indicated, the following doses of external radiation. The complete
radiation exposures of this employee are kept in the files of the Health Physics Division, PRIC.
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(rem) Ose (rea) Remarks JFORM, PRUC+HPD(PM)605 Director, Health Physics Division ---Page
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