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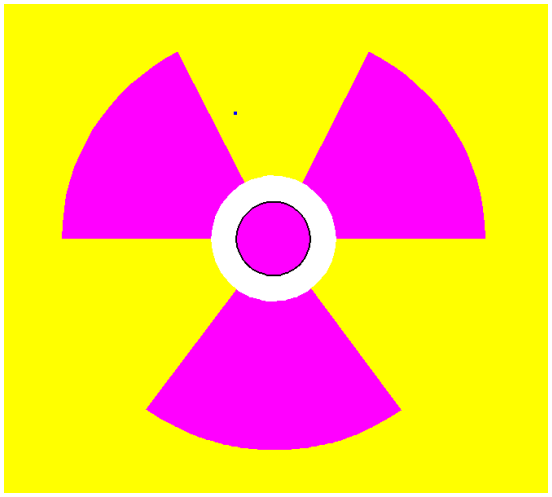
RADIATION SAFETY PROGRAM



Chapman University
Revision 2023-01

Approved By: Karen Swift Effective Date: April 20, 2023

Karen Swift
Radiation Safety Officer

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1.0 PURPOSE AND SCOPE

1.1 California Code of Regulations (CCR) Title 17, Div. 1, Chapter 5, Subchapter 4 section 30253 as referenced to 10 CFR 20.1101 requires users of ionizing radiation producing machines to develop and maintain a written Radiation Safety Program. This document satisfies the written Radiation Safety Program requirement and includes the procedures and guidelines established to ensure compliance with the applicable CCR and 10 CFR regulations for the Chapman University facilities at 346 and 450 North Center Street, Orange CA.

1.2 Chapman University has specifically and generally licensed radioactive material and ionizing radiation generating machines at these facilities. This written Radiation Safety Program covers the possession, use and control of these materials and devices.

1.3 Specifically licensed materials are limited to the isotopes and activity levels specified on our California Radioactive Materials License, 4948-30, for use as tracers in chemical and biological (in vitro) studies only. Copies of the license are available for inspection in the Chapman Environmental Health and Safety (EH&S) office.

1.4 Generally licensed devices are limited to the conditions of use specified in the applicable Sealed Source and Device Registry and manufacturers operating instructions.

1.5 Ionizing radiation machines are limited to industrial (non-medical) applications with energies less than 500kV and designed in compliance with applicable 21 CFR Subchapter J performance requirements.

2.0 ACRONYMS AND DEFINITIONS

2.1 **ALARA-As Low as Reasonably Achievable:** A program philosophy designed to maintain exposure to all individuals to levels as low as reasonably achievable within standard socio-economic considerations.

2.2 **Annual Limit of Intake (ALI):** The annual limit of an isotope which may be taken into the body as specified in appendix B of 10 CFR 20. Usually taken as the lowest ALI value listed for the isotope.

2.3 **Authorized Operator (AO):** An individual who meets the training requirements in section 17 of this written program and is authorized by the Radiation Safety Officer (RSO) to operate ionizing radiation producing machines. Operation includes starting and stopping x-ray production, setting technique factors (kV, mA, exposure duration, etc.) or loading/unloading samples into the irradiation chamber area.

2.4 **Authorized User (AU):** An individual identified on license 4948-30 who is qualified to use radioactive materials unsupervised or to supervise the use of the material by other individuals not specifically identified on the license.

2.5 **California Department of Public Health (CDPH) Radiologic Health Branch (RHB)**: Regulatory agency which controls licensing of radioactive materials and registration of radiation machines in California.

2.6 **Declared Pregnant Worker (DPW):** Individual working with or frequenting areas around radiation sources who voluntarily declare to their supervisor or the RSO in writing that they are pregnant and are subject to the embryo/fetus dose limits under 10 CFR 20.1208.

2.7 **Environmental Health & Safety (EH&S):** The Chapman University Environmental Health & Safety Office.

2.8 **Half Life ($T_{1/2}$):** The time for one half of the radioactive atoms of a specific isotope to undergo a decay or transition.

2.9 **High Radiation Area:** An area with accessible dose rates in excess of 100 mrem in an hour at 30 cm from the source or from any surface the radiation penetrates.

2.10 **Member of the Public**: Individuals present at the facility who are not directly involved with radiation sources and not frequenting areas with radiation sources present.

2.11 **Minor**: An individual less than 18 years of age who is authorized to work with radiation sources and is subject to the annual dose limits for a minor under 10 CFR 20.1207 (interns, students).

2.12 **National Voluntary Laboratory Accreditation Program (NVLAP):** Accrediting body for personal dosimetry processing services.

2.13 **Notice of Violation (NOV):** A citation or notice of deficiency issued by CDPH for failure to comply with radiation safety related regulations.

2.14 **Radiation Area**: An area with accessible dose rates in excess of 5 mrem in an hour at 30 cm from the source or from any surface the radiation penetrates.

2.15 **Radiation Safety Officer (RSO)** means an individual who meets the qualification requirements and is identified as the RSO on license 4948-30. Alternate RSOs (ARSO) may also be identified. If an individual is appointed as the RSO for radiation machines only, they will be identified as an XRSO. XRSOs are not qualified to supervise work with radioactive materials, only radiation machines.

2.16 **Radiation Source**: Radioactive materials or ionizing radiation producing machines.

2.17 **Restricted or Controlled Area**: An area where the entry is controlled for radiation protection purposes. An unrestricted area is an area that surrounds the restricted/controlled area and is not access limited for radiation protection purposes.

2.18 **Supervised User (SU)** for the purpose of this program means an individual working with radioactive materials under the general supervision of an AU and who meets the training requirements in section 17 of this written program.

2.18.1 General Supervision means the supervisor is responsible for and has control of the quality and technical aspects of procedures for radiation health and safety but does not have to be physically present in the same room with the SU while a procedure is being performed. The supervising individual must be immediately available to communicate with the SU.

2.18.2 Direct Supervision means the supervisor must be present in the area while the function is performed.

2.19 **Support Personnel (SP)**: Individuals not working with radiation sources but who need to frequently access areas where such sources are present (janitorial, security, administrative, etc.).

2.20 **Whole body or deep dose equivalent** (DDE): Dose received at a depth of 1 cm in tissue to the head, neck, truck, torso, pelvis, arms above the elbow and legs above the knee. Extremity or skin dose includes dose received at a depth of 0.007 cm in tissue to

arms below the elbow and legs below the knee or skin of the whole body. Eye dose includes dose received at a depth of 0.3 cm in eye/lens tissue.

3.0 ORGANIZATION AND RESPONSIBILITIES

3.1 **Radiation Safety Officer (RSO)**: A RSO will be designated in writing for each facility where licensed radioactive material or registered ionizing radiation producing machines are used or stored. The site may choose a single RSO for both radioactive materials and radiation machines or define separate individuals for each function/device.

3.2 Alternate Radiation Safety Officers (ARSO) may also be designated to support the RSO in implementing program functions. The RSO may assign in/all duties of the RSO to the ARSO but cannot delegate the responsibility for the function. Under the Chapman University program, the ARSO has been given the ability to perform all daily functions of the RSO.

3.3 The RSO or ARSO for licensed radioactive materials will be defined on the applicable license as approved by CDPH-RHB.

3.4 The XRSO, if applicable, for registered radiation machines will be defined on the RH2261 registration form, or in writing via the written Radiation Safety Program or memorandum from senior management.

3.5 The RSO or ARSO for radioactive material should have: a college degree in a physical science at the Bachelor's level or higher or equivalent training and experience, adequate experience working with the types and levels of radioactive material present and specific training in the RSO functions and duties applicable to the license. The RSO/ARSO are also considered AUs for the purposes of this program.

3.6 The XRSO, if applicable, should have adequate training and experience in the safe use, maintenance and regulatory requirements for the devices and specific training in the RSO functions and duties applicable to the devices.

3.7 The RSO is the designated site coordinator and primary liaison with CDPH for the Radiation Safety Program and responsible for:

3.7.1 Stopping any licensed material or registered ionizing radiation machine activities that the RSO considers unsafe.

3.7.2 Securing licensed material and registered ionizing radiation machines from unauthorized access or removal.

3.7.3 Using radiation protection procedures and controls to ensure occupational doses and doses to the public are ALARA.

3.7.4 Developing, documenting and implementing a radiation protection program (RPP) that is consistent with the scope and activities included in the license and registration and ensures compliance with the regulations and license conditions.

3.7.5 Ensuring the radiation safety program content and implementation is reviewed annually.

3.7.6 Demonstrating by measurement or calculation that no member of the public is likely to receive radiation exposures exceeding the regulatory limits in 10 CFR 20.1301 and 1302.

3.7.7 Ensuring individuals installing, relocating, maintaining, or repairing devices containing radioactive materials or sealed sources are trained and authorized by the State of California, the U.S. Nuclear Regulatory Commission (NRC) or Agreement State license.

3.7.8 Establishing and maintaining a personnel monitoring program. Providing personnel monitoring equipment, such as film badges, thermoluminescent dosimeters (TLD), or bioassays to individuals who are likely to receive more than 10% of the allowable radiation dose in one year for an adult or 100 mrem per gestation period or year for a DPW or minor or who enter a High Radiation Area. (10 CFR 20.1502).

3.7.9 Confirming personnel monitoring equipment is used and exchanged at the proper intervals as recommended by the manufacturer, and records are maintained.

3.7.10 Instructing individuals, working with or frequenting areas with radiation sources, on the potential health risks, effective use of protective devices, procedures required to minimize exposure to radioactive materials, and their responsibility to promptly report any conditions that may cause unnecessary exposures. (17 CCR 30255).

3.7.11 Complying with 17 CCR 30295 and immediately notifying CDPH of any incidents involving exposure to radiation sources, violations of regulations or license conditions. Follow-up with a written report that includes the corrective actions taken, preventive actions planned and the results of any evaluation.

3.7.12 Disposing, returning to manufacturer or transporting licensed material in accordance with all applicable 17 CCR, 10 CFR and 49 CFR requirements. Obtaining receipts acknowledging such activities. (17 CCR 30373).

3.7.13 Ensuring the LLRW report is submitted to CDPH annually.

3.7.14 Maintaining up-to-date licenses and registrations. Ensuring amendments and renewal Chapmans are submitted prior to the license expiration date. (17 CCR 30194) and fees are current.

3.7.15 Ensuring documents such as license information, regulations, normal and emergency operating procedures, and form RHB 2364 (Notice to Employees) are posted in conspicuous places. (17 CCR 30255).

3.7.16 Ensuring all equipment used and activities performed are limited to those specified in the license, the regulations, the Sealed Source and Device Registry (SSDR) certificate(s), and the manufacturer’s recommendations and instructions.

3.7.17 Ensuring radiation machines are registered within 30 days of receipt or disposition.

3.7.18 Ensuring generally licensed devices are registered with CDPH in accordance with 17 CCR 30108.1

3.7.19 Ensuring radiation surveys are performed by qualified individuals with appropriately calibrated instruments.

3.7.20 Ensuring sealed sources are inventoried every 6 months and tested for leakage as specified in the license.

3.7.21 Reviewing dose records and surveys to identify if trends indicate that operations are not being performed safely, staff training is inadequate, or engineering controls are unacceptable.

3.7.22 Maintaining a sufficient supply of properly calibrated and operable radiation survey instruments sensitive enough to detect low radiation and contamination levels. (10 CFR 39.33).

3.7.23 Submitting to RHB a written 30-day notification, a completed CDPH 5314 form (Certificate of Disposition of Materials), a final survey and receiving approval from CDPH prior to vacating a facility. (17 CCR 30256).

3.8 **Authorized Users (AU)**

3.8.1 AUs include those individuals who are qualified to use unsupervised or to supervise the use of licensed radioactive materials and are listed by name on the license. AUs may only be added to or removed from the license via a license amendment issued by CDPH-RHB. AUs are those individuals approved under and defined on the radioactive materials license as qualified to work with licensed radioactive materials unsupervised or supervise the use of licensed materials.

3.8.2 AUs should have a college degree in a physical science at the bachelor's level or higher, or equivalent training and experience and adequate training and experience working with the types and levels of radioactive material commensurate with the scope of work activities performed under the license.

3.8.3 AUs must complete the initial and annual refresher training as specified in section 17 of this program.

3.8.4 AUs are responsible for:

3.8.4.1 Performing work in accordance with applicable university procedures, policies, programs and training.

3.8.4.2 Following all laboratory safety rules and instructions for proper handling, receipt, control and storage of radioactive materials.

3.8.4.3 Maintaining their exposures ALARA during work.

3.8.4.4 Using assigned dosimetry properly, as applicable.

3.8.4.5 Notifying the RSO of any incidents or unusual occurrences related to safe use of radioactive material including spills, contamination incidents, loss or damage of dosimetry etc.

3.8.4.6 Supervising the work of SUs to ensure proper operating procedures and ALARA considerations are followed.

3.8.5 Service providers operating under a valid radioactive material service provider type license or representatives of a regulatory agency (CDPH-RHB) may enter radiologically controlled areas unsupervised and perform radiation safety support functions in these areas such as inspection, surveys, calibration, decontamination, waste consolidation/collection etc. These individuals may be considered trained and qualified under their own license and are not required to attend the Chapman initial or annual refresher training.

3.8.6 Individuals not covered under a valid service provider license performing routine functions in Restricted Areas will be treated as SUs or SPs and instructed in accordance with this radiation safety program or escorted as applicable. The RSO will maintain records documenting unescorted service provider qualifications/training.

3.9 **Supervised Users (SU):**

3.9.1 SUs are those individuals not approved under or defined on the radioactive materials license but are authorized by the RSO to work with licensed radioactive materials under the supervision of an AU.

3.9.2 Supervision does not require constant line of sight but does require periodic oversight to ensure proper safety methods are employed and compliance with appliable program requirements.

3.9.3 SUs should have adequate training and experience working with the types and levels of radioactive material commensurate with the scope of work activities performed and meet the initial and annual refresher training specified in section 17 of this program.

3.9.4 The RSO is responsible for maintaining a current list of SUs and verifying their training.

3.9.5 SUs are responsible for:

3.9.5.1 Following all laboratory safety rules and instructions for proper handling, receipt, control and storage of radioactive materials.

3.9.5.2 Maintaining their exposures ALARA during work.

3.9.5.3 Using assigned dosimetry properly, as applicable.

3.9.5.4 Notifying the RSO of any incidents or unusual occurrences related to safe use of radioactive material including spills, contamination incidents, loss or damage of dosimetry etc.

3.9.6 Service providers performing infrequent testing or maintenance outside of radiation safety support (mechanical repairs, inspections, BSC/Hood testing) should be appropriately trained or escorted by an AU/SU and/or the area in which they are working verified to be free of removable radioactive materials and radiation hazards.

3.10 Authorized Operators

3.10.1 Authorized operators (AO) include those individuals trained in accordance with section 17 of this program and approved to operate ionizing radiation producing machines unsupervised. Trainees may operate the machines under the direction of an AO, while they are being trained.

3.10.2 The RSO will maintain a list of AOs, including the devices for which they are qualified. Manufacturer's service representatives, service providers or support personnel who need to repair or maintain ionizing radiation machines may be considered trained and qualified as AOs under the service providers program and do not require escort or additional training unless the machines is located in an authorized use area for radioactive materials.

3.10.3 AOs are responsible for:

3.10.3.1 Following all laboratory safety rules and instructions for proper handling, receipt, control and storage of radiation machines.

3.10.3.2 Maintaining their exposures ALARA during work.

3.10.3.3 Using assigned dosimetry properly, as applicable.

3.10.3.4 Notifying the RSO of any incidents or unusual occurrences related to safe use of the devices, loss or damage of dosimetry etc.

3.11 Declared Pregnant Worker (DPW)

3.11.1 DPWs are those individuals working as an AU, SU or AO who voluntarily declare their pregnancy in writing and Chapman a lower dose limit for the duration of their pregnancy. Records of DPWs declaration will be maintained as a private/personal record. DPWs will receive additional training as specified in section 17 of this program.

3.12 Minors

3.12.1 Minors are those individuals working as an AU, SU or AO who are less than eighteen years of age. At the present time, Chapman's policy is not to allow minors to work as AUs, SUs, or AOs.

3.13 Support Personnel

3.13.1 Support personnel include those individuals who are working at the facility and may frequent areas where radioactive materials or ionizing radiation machines are used or stored as part of their work scope; but do not work directly with the material or machines. This includes housekeeping, maintenance, security or other persons who have reasons to frequent radiologically restricted areas for access to equipment, supplies, records or perform inspections or services on non- contaminated equipment.

3.13.2 Manufacturer's service representatives, service providers or support personnel who need to work in authorized use areas on potentially contaminated equipment (Hoods, BSCs, sewer release sinks etc.) will be escorted by an applicable AU/SU/AO, receive appropriate training or the area will be cleared of radiation hazards prior to the work.

3.14 **Members of the Public**

3.14.1 Members of the public include all other individuals in the vicinity of the facility, who are not working directly with radioactive material or radiation machines and not frequenting areas where such materials or machines are used or stored but may have access to the facility and occasionally enter areas where radiation sources are present. This includes administrative personnel or visitors.

3.14.2 Members of the public should not enter any radioactive materials use area unless escorted by an AU or SU or enter areas with operating radiation machines unless escorted by an AO. No additional access control restrictions are required for the areas around enclosed radiation generating machines such as electron microscopes, cabinet x-ray devices etc. or areas where the machines are not currently operating.

2.0 ALARA

2.1 Chapman is committed to maintaining exposures as low as reasonably achievable (ALARA) in all aspects of the Radiation Protection Program. Radiation source users and support staff will be made aware of this policy, and be provided with adequate training, supplies and equipment to maintain their exposures, and exposures to the general public, ALARA. The RSO will periodically review work practices to ensure that work functions are being performed in accordance with this policy. Additionally, the RSO will ensure periodic evaluations of work processes/controls are performed to determine if any additional modifications are reasonable which could further significantly reduce individual and collective dose.

3.0 DOSIMETRY

3.1 Based on the types and levels of material and devices used, personnel are not expected to receive more than 10% of the 10 CFR 20.1201 annual dose limits from external sources, have an uptake in excess of 10% of an annual limit of intake (ALI) or exceed 100 mrem/gestation period or year. In addition, no accessible High Radiation Areas are present. Therefore, personal dosimetry and routine bioassays are not required even for DPWs or minors. The RSO may choose to voluntarily issue dosimetry to select individuals even if not required.

3.2 The RSO will review the use of radiation sources and if conditions change such that exposures in excess of the monitoring limits are expected, appropriate personal dosimetry and/or bioassays will be required and provided. If dosimetry is issued:

3.2.1 The RSO will obtain and assign dosimetry from a NVLAP accredited provider to users as deemed appropriate; and collect the dosimetry for processing at least quarterly.

3.2.2 Individual personal dosimetry used for monitoring occupational exposure will be assigned to one individual only. The dosimetry should be marked with the individual’s name, initials or other identification number.

3.2.3 Personal dosimetry, when not in use, and control dosimetry, should be stored in low radiation background areas away from excessive heat, moisture or chemicals.

3.2.4 Users will be instructed on the proper methods for wearing and using the dosimetry.

3.2.5 DPWs who are likely to exceed 100 mrem over the gestation period will be provided fetal dosimetry which will be processed monthly and the fetus's dose limited to 50 mrem per month and 500 mrem over the gestation period. The adult occupational dose limits continue to apply to the DPW as long as the fetus dose limit is not exceeded.

3.2.6 The RSO, or designee, will review dosimetry results for trends or abnormal readings. Results which exceed 100 mrem per quarter for an AU/SU or 50 mrem per month for a DPW will be investigation and the investigation documented for cause and corrective actions.

3.3 For those individuals to whom dosimetry is voluntarily provided but not required, historical dose information will not be obtained/maintained. For individuals deemed monitoring required, historical dose information in accordance with 10 CFR 20.2104 will be maintained.

3.4 Nonroutine bioassays may be requested by the RSO following unplanned incidents with a potential for internal exposures in excess of 10% of an ALI. Bioassays may include urine sampling, whole body or thyroid scans which will be performed or analyzed by an authorized licensee. If results exceed 10% of an ALI and external exceeds 10% of the limit (or 100 mrem for a DPW), summation of external and internal dose will be performed, and the record maintained.

3.5 The RSO will review dosimetry results for abnormal readings or adverse trends and take appropriate corrective actions to ensure exposures remain ALARA. If a fetal dosimeter indicates more than 50 mrem in a month the RSO will perform an investigation of the dose results and take appropriate corrective actions to ensure the dose to the fetus remains below the regulatory limit.

3.6 The RSO will ensure monitored individuals are informed of their dose results at least annually or when requested.

3.7 The RSO will review dosimetry and survey results as applicable to verify no member of the public could exceed 2 mrem in any one hour and 100 mrem in any calendar year.

4.0 ORDERING RADIOACTIVE MATERIALS OR RADIATION MACHINES

4.1 Purchase requisitions for radioactive material including generally licensed devices or radiation machines should be reviewed and approved by the RSO/ARSO, or authorized designee, prior to placing a new order or increasing the level of radioactive material on a standing order. The RSO will ensure the order in addition to the material already at the site meets licensed possession and registration limits.

4.2 The purchasing department shall be alert for any purchase order that has not been approved by the RSO or authorized designee. Any purchase order submitted without this approval should not be processed and the RSO should be notified immediately.

4.3 Common vendors for radioactive materials are Perkin Elmer, GE Healthcare Life Sciences and MP Biomedicals. Common descriptive abbreviations used are µCi, mCi, MBq, H-3, S-35, C-14, P-32 and I-125.Common radiation machine terms include electron microscope, x-ray diffraction, x-ray fluorescence, x-ray machines etc. Common generally licensed devices are gas chromatographs, static eliminators, thickness or density gauges.

5.0 RECEIVING AND OPENING OF RADIOACTIVE MATERIALS OR RADIATION MACHINES

5.1 Routine Deliveries of radioactive material including generally licensed devices will be performed during normal working hours unless special arrangements have been made by the RSO.

5.2 Shipping and receiving personnel are normally the first persons to accept incoming radioactive material shipments at Chapman.

5.3 The RSO, AU, SU or a trained designee, will examine the package for damage and labels and follow the PACKAGE OPENING PROCEDURES below.

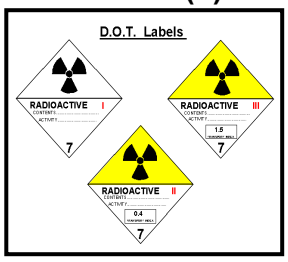
5.4 Package receiving personnel will document incoming radioactive materials, including date received, name of receiver, isotope, activity, supplier, labeling/condition and contamination levels (if applicable).

5.5 Only persons specifically trained in these procedures will open packages containing radioactive materials.

5.6 Chapman will not receive packages containing radioactive materials in excess of Type A quantities, as defined in 10 CFR 71.4 and Appendix A to 10 CFR 71, and dose rate surveys will not be required unless damaged.

5.7 The external package will be inspected for DOT Hazard Class labels and damage or leakage prior to opening. Most packages received will be Excepted Package-Limited Quantity of material and will not have a DOT Hazard Class label but will bear the Excepted Package marking with the UN2910 or UN2911 number designation.

Illustration (1)



5.8 If the external package is damaged or if the package is labeled with one of the DOT labels shown in illustration (1), perform the following contamination surveys within 3 hours of receipt. Note if the package is not damaged or is not labeled with one of the DOT labels, surveys are not required.

5.9 If the package is damaged notify the RSO for additional instructions. Under these conditions both wipe tests and dose rate surveys are required. If damaged, put on gloves and place the package in a plastic bag prior to handling/surveying.

5.10 For DOT labeled or damaged packages wipe test representative portions of all sides of the external package surfaces for removable contamination. Each wipe test should be at least 300 cm^2. Wipe test samples should be counted in a liquid scintillation counter and the results corrected for counting efficiency to determine total dpm/wipe. If the surface contamination is less than 200 dpm on the wipe sample, and the package was not damaged, the package and contents may be released for use. NOTE: the contamination limits are 240 dpm/cm^2 for 49 CFR transport considerations; however, the internal limit for the laboratory is 200 $dpm/100\ cm^2$. The wipe results for any receipt survey must be corrected for collection efficiency of 10% prior to comparing to the 49CFR transport limits.

5.11 If the package was damaged or the external surface results indicate greater than 200 dpm on the wipe, assume the package and the internal contents are contaminated.

5.12 Under direction of the RSO or designee, carefully open the package and determine if the contents are damaged. Take additional wipe samples of the inside containers and verify the contamination levels.

5.13 If the wipe results indicate greater than 200 dpm on the external or internal package notify the RSO. The RSO will ensure the wipe results are corrected for the collection efficiency of the sample method (multiply the dpm by 10 for a 10% collection efficiency) and determine if the 49CFR transport limits have been exceeded. If the limits have been exceeded the RSO will notify the final delivery carrier and by telephone and telegram, mailgram or facsimile the Nuclear Regulatory Commission's Regional Office (as listed in Appendix D to 10 CFR part 20) and the State of California, Department of Public Health, Radiological Branch.

5.14 If the package is contaminated, leave the package stored in the plastic bag in the designated storage area, and label with a Caution Radioactive Material label. The RSO will determine the appropriate disposition for the material and follow up actions/surveys of the receiving area.

5.15 If the wipe sample does not indicate greater than 200 dpm removable contamination on the external package or contents, the package can be dispositioned as not contaminated.

5.16 Note there are no special receipt or opening requirements for radiation machines. These devices may be set up by the manufacturer/distributor. An initial survey of emissions and interlock tests should be completed prior to first use.

5.17 New radiation machines will be registered with CDPH within 30 days of receipt on a RH2261 form for each applicable registered facility address/code.

5.18 Generally licensed devices will be registered with CDPH within 30 days of receipt on a CDPH 8240 form if applicable.

6.0 POSTING, LABELING AND ACCESS CONTROL

6.1 The authorized use and storage areas for radioactive material at the Chapman facility are locked and secured from unauthorized access when not manned by Chapman employees. The authorized radiation use areas will be controlled via key card, physical lock or applicable administrative controls.

6.2 All use and storage of specifically licensed radiation sources will be conducted inside of a designated and properly posted use area (in accordance with 10CFR 20.1901 through 1903). The area where radioactive materials are used or stored at a minimum will be posted with the "Caution Radioactive Material" signage including the trefoil. The area or x-ray enclosure where the radiation machines are located will be posted "Caution X-Ray". Signs will be yellow and magenta or yellow and black.

6.3 Sources which are in use will be under the control of a qualified AU/SU for radioactive materials or an AO/SO for radiation machines. The user/operator is responsible for ensuring no unauthorized access to the material/machines occurs during use and that the material is secured from unauthorized access when returned to storage. I

6.4 If radiation sources are found to be missing, the issue will be reported promptly to the RSO for investigation.

6.5 The RSO will ensure a current copy(s) of the RH2364 form is posted near the entrances or egress to the areas or on common hallways in the facility in accordance with California Title 17, section 30255.

6.6 A note indicating where the license support documentation (license, regulations (both 17 CCR and referenced sections of 10CFR), normal and emergency procedures etc.) are located will be posted near the RH2364.

6.7 Emergency contact information for the RSO, CDPH emergency number and local inspection agency should be posted near the entrances or devices.

6.8 Notices of Violation (NOVs) and responses will be posted near the entrance to the facility for 5 days or until the issue is closed, whichever is longer. Notices and responses should be posted within 2 days of receipt or dispatch.

6.9 Areas and containers will be posted and labeled in accordance with 10CFR20.1901 through 1905 as applicable.

6.10 Areas where generally licensed radioactive materials are used are not required to be posted with the caution signage or the RH2364 information.

6.11 Based on the isotopes, activity levels and radiation machines present at Chapman, Radiation, High Radiation or Airborne Radioactivity Areas are not expected.

7.0 USE AND STORAGE OF RADIOACTIVE MATERIALS

7.1 Eating, drinking, smoking or applying cosmetics in areas where unsealed radioactive materials are used or stored is not allowed.

7.2 Only authorized personnel will use radioactive materials. Trainees will use radioactive materials under the supervision of authorized users.

7.3 Mouth pipetting of any substance is forbidden.

7.4 Hands, shoes, clothing and work surfaces should be monitored with an appropriate calibrated contamination meter (excluding H-3).

7.5 Radioactive material contaminated equipment and contaminated areas must be properly labeled and kept in a designated area when not in use. Within larger labs where mixed use (radioactive and non-radioactive work) occurs all areas where radionuclides are used or stored must be properly designated with signs and/or tape containing the radiation warning symbol and the words “Caution Radioactive Material”.

7.6 Suitable protective clothing (typically lab coat and disposable gloves) shall be worn when working with unsealed radioactive materials. Safety glasses shall be worn if there is a danger of liquid splash. Lab coats used in radiologically controlled areas should remain in those areas unless surveyed and verified free of contamination.

7.7 Trays, which will hold the radioactive materials in the event of spills or breakage should be used during storage or transport between laboratory areas and in common hallways.

7.8 Whenever possible, work surfaces should be covered with plastic-backed absorbent paper with plastic side down. Where practical, an impervious tray or pan should be used under the paper in order to ensure containment of spills.

7.9 Liquid radioactive materials should be stored in sealed containers within a secondary containment.

7.10 Individual containers of radioactive material (including waste) will be labeled/tagged. The label or tag must have the radiation-warning trefoil symbol and the words Caution – Radioactive Materials. The tag should also indicate the radionuclide(s), activity and the date the activity was determined. Secondary containers such as cabinets, freezers etc. will also be labeled with the radiation trefoil symbol and the words “Caution Radioactive Material”.

7.11 Lead foil or other shielding and remote handling tools should be used to minimize radiation exposure to laboratory personnel as applicable. Shielding should be considered when handling greater than 1 mCi of I-125 or other gamma emitters or high energy beta emitters. Shielding is not generally required for containers of H-3 or C-14 at the quantities used by Chapman. If shielding for high energy betas is required it will be made of low density plastic, acrylic or Lucite material.

7.12 Personnel will be instructed if an accident occurs involving radioactive materials, to treat serious physical injuries before attempting decontamination. All spills should be cleaned up promptly when they occur. Spills and injuries involving radioactive materials should be reported to the Radiation Safety Officer.

7.13 Radioactive materials and contaminated equipment should be secured from unauthorized removal.

7.14 Only sinks specifically designated and approved for radioactive sewer disposal may be used to release radioactive materials. Radioactive waste must be placed in special radioactive waste containers provided by the RSO or his/her designee. Do not place radioactive waste in the ordinary trash containers. Do not dispose of radioactive waste into a sink unless that sink is specifically designated by the Radiation Safety Officer. At the current time no sinks or drains at the Chapman site are authorized for radioactive material disposal.

8.0 USE AND STORAGE OF RADIATION MACHINES

8.1 Only authorized operators will operate radiation machines unsupervised. Trainees will use radiation machines under the direct supervision of an AO.

8.2 No special personnel protective equipment, PPE, is required for the operation of enclosed or cabinet x-ray systems. PPE may be required for other cleanliness or chemical safety requirements and should be worn as directed for those considerations when using the machines.

8.3 The devices will be set up and operated in accordance with the manufacturer’s operating manual and instructions. Only those individuals who have received the radiation safety training and are designated as AOs may use radiation machines. In addition, AOs using a cabinet x-ray system must successfully complete a 50-question written exam and 25 point practical factors evaluation both with a score of at least 80%.

8.4 The radiation machines at the site are not for use on living humans.

8.5 When not in use the enable keys should be removed and secured from unauthorized

access and any passwords to initiate operation should be controlled.

8.6 The operator is responsible for performing a visual inspection of the system prior to use including ensuring warning lights and safety features are functioning correctly. The system is not to be used if any visible damage which could impact safe operation is present or the safety and warning devices are not functioning.

8.7 Chapman operators and employees are not authorized to perform any maintenance or service on the radiation machines other than daily observations, operability checks, external cleaning, and functions defined in the operator manual which don't require access to the primary beam or x-ray generator, etc.

9.0 SURVEYS FOR RADIOACTIVE MATERIALS

9.1 Routine contamination surveys will be conducted monthly in areas where unsealed radioactive materials are used. Special surveys will be conducted following incidents involving spills or as conditions warrant. Dose rate surveys will be performed in areas using gamma emitting or high energy beta (P-32) emitting radioactive materials.

9.2 All surveys will be performed with properly calibrated and functioning instruments appropriate for the levels and types of radiation used. Instruments must be calibrated within the last 12 months.

9.3 Dose rates when required should be obtained on contact with and at 30 cm from radiation storage containers and work areas. In addition, general area dose rates should be assessed approximately 1 meter above the floor and 1 meter away from source storage or work areas. Surveys should be performed at the boundary to the radiation use areas to verify the maximum dose rate is less than 2 mrem in any one hour and less than 50 µrem/hr. average. These surveys may be used to support the annual public dose assessment.

9.4 Contamination surveys will be performed in areas where unsealed radioactive materials are used or stored and in adjacent areas.

9.5 For wipe samples: Using filter papers or swabs take a series of wipe test samples on laboratory surfaces paying particular attention to surfaces that personnel come in contact with such as bench tops, handles, and equipment buttons. Each wipe area should be at least 100 cm^2. Count the wipe samples in a liquid scintillation counter (LSC) or applicable beta or gamma counting system depending on the isotopes expected. NOTE: H-3, C-14, S-35 must be counted on an LSC; I-125 and Cr-51 may be counted on the LSC or a gamma counter.

9.5.1 Calculate the Minimum Detectable Net Count (Cn) of the counting system, using the following equation: Where Count background is the result of counting a blank sample.

$$MinimumNetCount(C_n) = 3 + 4.65\sqrt{Count_{(backgroud)}}$$

9.6 Calculate the minimum detectable activity by dividing the *Cn* by the counting time in minutes and the counting efficiency. Ensure the minimum detectable activity is less than 200 dpm. If it is not less than 200 dpm, count samples for a longer period of time or use an analysis system with a higher efficiency.

9.7 Count wipe samples for the same duration as the background samples. Determine the net count rate by subtracting the background count from the gross sample count, then divide by the counting time and efficiency to determine the results in dpm. Decontaminate any areas where a net sample result is greater than 200 dpm. Consider decontaminating areas where the sample count exceeds the *Cn*. Surveys will be documented on a form showing a sketch of the laboratory and location of the radioactive materials work/storage areas. The map should indicate where wipe samples were taken and places where contamination levels or dose rates are measured.

9.8 The record should include the date of survey, name of individual performing the survey, make/model/serial numbers of instruments used. Changes to survey records should be made with a single cross-out and initial and date of change. Dose rates should be recorded in mrem/hr (mR/hr) or multiples thereof. Contamination from wipe samples should be recorded in dpm.

9.9 The RSO should review the survey results for contamination, unusual results, dose rates above posting or action points or negative trends.

10.0 LEAK TESTING & INVENTORY SEALED SOURCES

10.1 Specifically licensed sealed sources will be physically inventoried every six months. The inventory will be documented and will identify the sealed source by isotope, current activity, serial number, make/model, storage location.

10.2 Specifically and Generally licensed sealed sources (other than H-3, Kr-85, sources in gaseous form, beta/gamma sources ≤ 100 µCi, alpha sources ≤ 10 µCi or sources with half-lives less than 30 days) will be leak tested for contamination every six months or as required by the Sealed Source and Device Registry (SSDR) for the source. If the SSDR allows a longer leak test frequency than the 6 months, the RSO must maintain a copy of the SSDR for as long as the associated leak test records must be maintained.

10.3 Leak tests will be collected by the RSO or other qualified individuals designated in writing by the RSO.

10.4 Leak test samples will be analyzed by someone specifically authorized to perform that service and results recorded in units or Bq (µCi). Sample analysis must be capable of detecting 185 Bq (0.005 µCi) of the isotope being sampled.

10.5 Samples which indicate ≥ 185 Bq (0.005 Cµi) of activity will be removed from service, properly dispositioned and results reported to CDPH within five days of the test. The report must include a description of the defective source, the test results and the corrective actions taken.

11.0 SURVEYS FOR RADIATION MACHINES

11.1 Surveys should be performed upon initial installation, following any move of the system to a new location, following maintenance or repair which could alter the output or the shielding of the system, following identification of abnormal conditions which might impact the safety of the system and periodically as determined by the RSO.

11.2 Emission surveys and interlock tests of cabinet x-ray systems (XRC) will be performed

at a minimum annually. Surveys will be performed at 5 cm from all accessible surfaces during maximum operating conditions. Devices which indicate > 5 mR in an hour at 5 cm from the surface will be removed from service until the situation is corrected.

11.3 All surveys will be performed with properly calibrated and functioning instruments appropriate for the levels and types of radiation used. Instruments must be calibrated within the last 12 months. Results will be recorded in mR/hr.

11.4 The RSO/XRSO should review the survey results for any systems which exceed action points, have higher than expected readings or display negative trends.

12.0 TRANSPORTING OR SHIPPING RADIOACTIVE MATERIALS

12.1 If radioactive materials are sent offsite for testing, transfer or disposal the RSO will ensure that the following conditions have been met prior to allowing transfer of the material.

12.1.1 Radioactive materials will be sent to the attention of the RSO at the receiving facility or applicable designee of the licensed waste broker.

12.1.2 The RSO must verify that the receiving facility is licensed to possess the materials and a copy of their current license should be on file in the RSO office.

12.2 If the material is exempt from the Hazardous materials regulations per 49 CFR 173.436, then the material may be shipped without the hazardous materials transport controls defined below. If the material is not exempt from hazardous material transport controls, the RSO will assure that the following conditions have been met prior to allowing transport of radioactive materials:

12.2.1 The package, marking, labels and shipping papers must meet the specifications described in the U.S. Department of Transportation regulations (49 CFR).

12.2.2 Persons that load, package, mark, prepare shipping paperwork, offer the material to a third-party carrier or transport the materials will be trained in accordance with 49 CFR 172 (or IATA) requirements.

12.3 If the quantity of material to be shipped is greater than a Limited Quantity [49 CFR 173.421- 424], the RSO must ensure that the package is a DOT TYPE "A" package and that a certificate stating that the package meets the TYPE "A" specifications is kept on file for at least one year after the shipment date.

12.4 There are no special hazardous materials shipping controls for radiation machines.

13.0 COLLECTION AND DISPOSITION OF RADIOACTIVE WASTE

13.1 Radioactive material must be segregated by form (i.e. dry, liquid, scintillation vials) and half-life (> 120 days and ≤ 120 days). Separate containers should be provided for each class of waste. The containers should be clearly marked to indicate the class/type of material allowed in the container).

13.2 When possible, any combined radioactive and pathogenic waste should be inactivated at the source. Use appropriate cold sterilization techniques for the pathogen involved.

Contact the RSO for specific instructions if standard techniques are not possible. Development of radioactive chemical waste should be avoided, or if the half-life is less than 120 days, held for decay in storage and then managed as chemical waste.

13.3 Use properly labeled small bench top containers to collect dry waste near work areas as applicable. When filled transfer to the designated and labeled waste collection container (2 cf cardboard boxes, 30 or 55 gallon drums, etc.). Dry waste containers must not include any liquid or wet waste. Each container should be lined with a 4 mil, plastic liner. When full, tie or tape the liner shut and close the container.

13.4 Contaminated sharps will be collected in a hard walled, leak-proof container. Plastic sharps boxes are appropriate. These containers must not contain free or contained liquids (such as full syringes). The term “sharps” includes needles, pipettes, pipette tips, burettes, broken glass or any object that has the ability to penetrate a plastic bag.

13.5 Liquid waste includes the radioactive solution and at least the first rinse of the container which held the solution. No solid material may be placed in the liquid container (e.g., no pipettes, plastic pipette tips, microcentrifuge tubes, electrophoresis gels or organic matter). Liquid waste must be stored in non-breakable plastic or metal containers. Liquid waste should remain capped at all times, except when adding material. Waste containers greater than 1 gallon should be stored in a secondary container (bucket/tray) capable of holding the entire contents of the original container.

13.6 Scintillation vials and plates should be stored in cardboard flats or plastic lined (4 mil) boxes or drums. Ensure vial caps are securely closed. Line the drum/container, then fill the drum liner 1 foot high with absorbent material and place second liner inside first liner on top of absorbent. When the drum is full, tie or tape the liner shut and close the container. Note: scintillations vials with less than 0.05 microcurie (1.85 kBq), or less, of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting solution may be disposed of as non-radioactive waste per 10 CFR 20.2005.

13.7 The RSO should be contacted for disposal of any stock solutions or high activity waste. Waste which is volatile such as I-125 should be stored in closed waste receptacles.

13.8 Waste collection containers must be labeled with the radiation trefoil, “Caution Radioactive Material”, isotope, estimated activity and date of assessment. Labels and markings must be conspicuous so other employees recognize them and do not inadvertently remove these containers from the use or storage area.

13.9 Non-radioactive waste containers in authorized use areas with unsealed radioactive materials will be evaluated for contamination prior to release from the area as clean waste.

13.10 Waste will be transferred to a license broker, disposal or treatment facility, or decayed in storage on site. The RSO will ensure a SouthWest Compact export permit is obtained as applicable for any waste transferred off site.

13.11 The RSO will ensure that all LLRW waste shipped within the calendar year, or held for decay in storage, or awaiting shipment at the end of the year is reported to California Department of Public Health per the California Health & Safety code on an annual basis

13.12 Decay in Storage

13.12.1 Only material with a half- life less than or equal to 120 days will be decayed in storage (P-32).

13.12.2 Material being decayed in storage will be defaced of any radioactive material or radiation warning labels prior to being placed into the decay in storage container.

13.12.3 The material will be placed in a designated receptacle (if solid the container will be lined with plastic without any radiation markings).

13.12.4 When the container is full the bag liner will be closed with tape if applicable, then the container securely closed and taped shut. The container will be marked with the date of closure, isotopes and estimated activity. The external container will be marked or tagged with the radiation symbol and the words Caution Radioactive Materials.

13.12.5 A log will be maintained which indicates the container ID, the date of closure, the isotopes included, the date of final survey and results, name of surveyor, instrument used and the date of release.

13.12.6 The material must be held for a minimum of 10 half- lives. At the end of the decay period based on the longest half- life material in the container, the contents will be surveyed with a GM pancake detector for P-32 or a NaI detector for gamma emitters. The survey will be performed in a low background area. If the container and contents are completely defaced of radioactive markings, the wait period has been met, and the survey indicates no detectable contamination, then the contents may be released to the land fill or disposed of as general laboratory waste through a designated waste vendor. If detectable activity is measured, the container must be held longer, and resurveyed until no detectable activity is measured prior to release.

14.0 EFFLUENT AND ENVIRONMENTAL RELEASE AND MONITORING

14.1 Releases to the Sanitary Sewer. There are currently no liquids authorized for sanitary sewer disposal.

14.2 Other Releases to the Environment. Chapman does not generate any radioactive airborne or effluent releases to the environment as a result of licensed activities.

15.0 DISPOSITION OF RADIATION MACHINES

15.1 If radiation machines are no longer required, the RSO will report the sale, transfer, or discontinuance of the device within 30 days to the California Department of Public Health, Radiologic Branch on a revised Radiation Machine Registration (Form RH-2261).

15.2 Chapman will follow the disposal instructions provided by the manufacturer in the product manual, and/or contact the manufacturer for information and guidance. Some x-ray tubes include other hazardous materials such as beryllium windows that must be controlled as hazardous waste for disposal.

15.3 When manufacturer guidance is not available:

15.3.1 The machine will be returned to a commercial X-Ray machine assembler or vendor, or

15.3.2 The machine will be disabled, and the components sold as scrap metal or disposed of according to local requirements or

15.3.3 The machine may be rendered non-functional by disassembly and/or component removal such that the generation of radiation is not possible.

16.0 EMERGENCY PROCEDURES

16.1 Any AU, SU, AO, SO or safety department member involved in or witnessing a radiological incident is responsible to oversee and perform the requirements of this procedure until qualified management personnel are present on site. After that time, it is the responsibility of the most senior qualified manager available to implement this procedure.

16.2 For radiation contamination incidents, the RSO has the responsibility for restricting or allowing access to a location where contamination is possible and for supervision and monitoring of areas for contamination and decontamination processes following a major radiological incident.

16.3 Radiological incidents are to be reported to the RSO as soon as practical with the exception of easily cleaned minor surface contamination incidents. The RSO or designee will determine if the incident is reportable under 17 CCR 30295. For nonreportable incidents (i.e., minor spills/accidents), the RSO should arrive at the scene and proceed to control, mitigate, and eliminate consequences of the accident.

16.4 For reportable incidents, the RSO will notify police or emergency services as applicable who will then act as the First Responders crew. Members of the RSO staff are not considered First Responders but will be available to provide guidance and support to the responders assisting with facility specifications and radiation protection.

16.5 All incidents must be documented and include a final survey indicating contamination has been removed or mitigated as applicable. Reportable incidents will be reported to CDPH by the RSO with an investigation into the root cause.

16.6 Due to the very low levels of radioactive material present at Chapman, major incidents are not expected. In the event of a personal injury in a radioactive material use area the health and safety of the injured person should be the highest priority and not the consideration of contamination.

16.7 For personal injuries, promptly assess the extent and seriousness of the injury and potential for contamination or other hazards in the area.

16.8 If the injury requires immediate medical attention call 911 and then contact the RSO.

16.8.1 Notify all people in the area and stop work. Evacuate any nonessential personnel.

16.8.2 Assign someone to direct the arriving First Responders and Ambulance to the incident scene and escort them to the injured person. If time allows inform the responders where radioactive materials are stored and/or located as well as any precautions to avoid and provide them protective equipment as applicable.

16.8.3 Emergency responders should take charge upon arrival and proceed with assistance by the RSO or designee. The RSO may establish a controlled area where individuals may be surveyed for contamination as appropriate without interfering with support to the injured individual. If the injured person is contaminated, the person may be transported on a gurney and covered in a sheet.

16.8.4 Following assessment and actions by the emergency responders, the RSO will assess the potential for internal exposure, determine if bioassays are warranted, perform area and personnel surveys and establish follow-up controls for the area and any impacted areas such as the ambulance, responders equipment etc.

16.9 Minor Spills: A minor spill means the release or dropping of small volumes of radioactive materials. A minor spill might result from drops from a pipette, syringe or breakage of glassware. Minor spills are normally considered incidents involving less than 100 times the surface contamination limit (<20,000 dpm/100 cm^2), less than 5 times the lowest applicable ALI and where the restriction on access to the area does not exceed 24 hours excluding incidents with isotopes where the half-life (T1/2) is less than 24 hours. If an incident involves transport of a potentially contaminated injured person it should be considered a major incident/spill.

16.9.1 AUs/SUs will be instructed to wear gloves and suitable protective clothing, stop the source of the spill, control the spread, identify the contaminated area, decontaminate, then monitor hands and clothing for contamination.

16.9.2 Prevent the spread by covering the spill with absorbent paper. Paper should be dampened if solids are spilled.

16.9.3 Carefully fold the absorbent paper with the clean side out and place in a plastic bag for transfer to a radioactive waste container. Put contaminated gloves and any other contaminated disposable material in the bag.

16.9.4 Survey the area with an appropriate low range radiation detector. Check the area around the spill for contamination. Then monitor hands, clothing and shoes as applicable.

16.9.5 The spill area will be decontaminated and monitored for fixed and removable contamination.

16.9.6 The RSO should be notified of all spills and cleanup. Follow any additional instructions from the RSO for bioassay samples, documentation etc.

16.10 Major Spills: A major spill means the spilling or release of large quantities or concentrated solutions of radioactive materials resulting in gross contamination of personnel or laboratory surfaces or a reportable incident per 17 CCR 30295.

16.10.1 AUs/SUs will be instructed to only secure the container and stop the spill if it can be done without further contamination or significant increase in radiation exposure.

16.10.2 Follow the general guidelines above for a minor spill to eliminate or mitigate the release of radioactive material such as placing absorbent materials on a liquid spill or gently wet down a spill of dry or powdered materials.

16.10.3 AUs/SUs should inform the RSO and others in the area that a spill has occurred and clear and keep traffic away from the impacted area. The

responders should maintain surveillance over the spill area and wait for instructions from the RSO. If high radiation levels or possible airborne contamination from volatile or dispersible material is possible, evacuate the laboratory immediately and secure to prevent entry. Avoid unnecessary movement or touching of surfaces.

16.10.4 Hands and clothing of all personnel potentially contaminated by the incident should be surveyed with an appropriate instrument. Contaminated hands and skin should be washed with warm water and soap. Avoid harsh scrubbing which may increase skin penetration or spread contamination. If contamination persists the RSO may prescribe different stronger decontamination methods. Contaminated clothing should be removed and sealed in plastic bags for disposition. The RSO or designee should supervise decontamination activities.

16.10.5 Close the room and lock or otherwise secure the area to prevent reentry until cleared by the RSO. The Laboratory supervisor or RSO will complete a report of the cause of the incident and actions to prevent recurrence.

16.11 Minor Fires: Local minor fires (waste container etc.) which can be contained and promptly put out using a regular fire extinguisher and which do not create a threat to hazardous materials are considered minor fires.

16.11.1 Notify persons present to vacate the area and have one individual call the RSO and fire department ifs instructed by the RSO.

16.11.2 Immediately attempt to put out the fire by approved methods if other hazards are not present. If this fails, consider the fire a major fire.

16.11.3 Once the fire is out, isolate and survey the area or impacted persons to prevent the spread of possible contamination as applicable. Decontaminate using the same methods as noted for spills.

16.12 Major Fires: Fires which cannot be contained and promptly put out by a regular fire extinguisher, or which create a threat for hazardous materials are considered major fires.

16.12.1 Notify persons present to vacate the area and have one individual call 911 and then the RSO.

16.12.2 Assign someone to direct the arriving Fire Department to the incident scene and escort them as applicable.

16.12.3 Upon arrival of the Fire Department, inform them where radioactive materials are used or stored, best possible entrance route, as well as any precautions to avoid exposure or risk of creating and spreading contamination by use of high pressure water etc. The Fire Department personnel will take charge upon arrival and proceed with assistance from the RSO or designee.

16.12.4 Once persons are evacuated and the fire is extinguished, isolate the area to prevent the spread of possible contamination. Do not allow reentry into the area until approved by the Emergency Responders and until potential contamination is identified and decontaminated.

16.12.5 Survey impacted personnel and decontaminated if applicable. The RSO or designee should supervise decontamination. If personal decontamination was not successful, consider inducing perspiration by covering the area with plastic, then rewashing.

16.12.6 The RSO may establish a controlled area where the responders and their equipment can be surveyed for contamination as applicable. The RSO will determine if any additional bioassays or follow up actions are required and if the incident is reportable to CDPH.

16.13 Security Threat, Natural Disaster or Loss of Material:

16.13.1 Any major natural disaster (fires, tornados, floods, explosion, epidemic) that requires significant emergency response will be coordinated with the applicable emergency response organization. The major function of Chapman staff is to assist with facility specifications, radiation protection for responders etc. Follow the general guidelines below to evacuate the area and notify the responsible organization (police, fire, etc.)

16.13.2 A security threat to a radiological laboratory, control of radioactive materials or radiation producing machines, or the welfare of personnel is considered an extremely serious event. It should be noted that the actual health risk from radiation at Chapman is very small, especially when compared to the hazards present from a potential security threat.

16.13.3 If an individual attempts to enter a radiologically controlled area unauthorized but no immediate threat is identified, inform the person that the area is restricted for radiation protection and escort them from the area.

16.13.4 Try to determine, if possible, why the person attempted entry and their contact information. Report the incident to the RSO. Instruct the individual in the radiation hazards and suggest they contact the RSO for further information or questions.

16.13.5 If a threat is suspected (bomb or active shooter etc.), do not confront the individual or place yourself in an unsafe condition. Immediately try to leave the area and warn any other individuals who may be present. Notify campus security, call 911 and contact the RSO. Emergency responders/police will take charge upon arrival and proceed with assistance of the RSO or designee. The RSO will allow no one to return to the area unless approved by the Emergency Responders.

16.13.6 Once the threat or emergency is eliminated, advise the emergency responders of the presence of any radioactive materials/contamination. Survey the responders and their equipment if necessary. The RSO will notify CDPH as applicable.

16.13.7 If loss of radioactive material is identified immediately notify the RSO. The RSO will perform an investigation, determine if the incident is reportable to CDPH and instruct staff on any follow-up actions.

16.14 Each authorized use or radiological restricted area will be posted with the emergency contact information or equivalent as noted below

Emergency Contacts	Office Phone Number	After Hours
RSO: Karen Swift swift@chapman.edu	**(714) 628-2888**	**(714) 628-2888**
Radiologic Health Branch - Sacramento	**(916) 327-5106**	
Radiation Emergency Services	**(800) 852-7550**	

Radiologic Health Branch Brea	**(714) 524-1409 or (714) 524-1908**

17.0 TRAINING PROGRAM

17.1 Training may be provided via classroom, on-line, required reading or any other acceptable medium.

17.2 AUs/SUs will be given an initial and annual refresher training. Half of the initial session will cover the administrative procedures detailed in the radiation safety program, including sections of CCR Title 17 Radiation Control Regulations that are applicable to the new employee. The other half of the session will cover a review of basic physical concepts of radiation protection and control. Refresher training will be given annually thereafter and include any changes to the initial topic or review of previous items.

17.3 AOs will be given an initial orientation session. Half of the session will cover the administrative procedures detailed in the radiation safety program, including sections of CCR Title 17 Radiation Control Regulations that are applicable to the new employee and required safety features of the equipment. The other half of the session will cover a review of basic physical concepts of radiation protection and control. Operators of an XRC will be required to complete a 50 question written test with an 80% passing score and a 25 point practical factors evaluation with an 80% passing score.

17.4 DPWs will receive in addition to the basic radiation safety training above will be instructed on the sensitivity of fetal tissue in accordance with the Appendix to US NRC Regulatory Guide 8.13. A copy of the guide will be provided to the employee and reviewed.

17.5 Support Staff will be provided an instruction commensurate with the scope of their duties and the areas they will access. The instruction may be through classroom, online reading or a Memorandum of Understanding (MOU). The instruction should explain the basic information on the presence of radioactive materials, the type of work the individuals are allowed to perform and who to contact for additional information. An example memorandum of understanding is provided below.

MEMORANDUM OF UNDERSTANDING

TO: Persons who have reason to frequent the designated radiation use areas at Chapman

FROM: Radiation Safety Officer

SUBJECT: Radiation Safety in Restricted Areas

Small quantities of radioactive materials are used in our facilities. The doors to some rooms, cabinets, containers or pieces of equipment may be posted or labeled with the radiation

warning symbol and the words CAUTION - RADIOACTIVE MATERIALS. This is to warn you that you should not handle these containers or pieces of equipment.

It is safe to enter these laboratories to perform routine work duties. You should be on guard in case you find a broken or leaking container with the CAUTION - RADIOACTIVE MATERIALS label on it. If you do find this, close and lock the door behind you and immediately report this to your supervisor. This condition does not represent a hazard to you.

Housekeeping personnel should realize that special waste containers marked with the radiation warning symbol and the words CAUTION - RADIOACTIVE MATERIALS will be present in the laboratory. You should not handle these containers. Special procedures are required for processing this waste and you are not expected to empty or remove this container from the laboratory. Working next to these containers for the time it takes you to do your work does not represent a hazard to you.

Please take this time to think about radioactive materials and ask any questions that you have about them. If you think of questions at any time after this, present them to the Radiation Safety Officer.

_____	_____	
Print Name	Signature	Date
_____	_____	
Print Name	Signature	Date
_____	_____	

18.0 DECOMMISSIONING AND DECONTAMINATION PLANS

18.1 Chapman will follow the requirements in 17 CCR 30256 prior to vacating a licensed facility or releasing controlled areas for unrestricted use.

18.2 A comprehensive radiation survey will be done. The survey shall utilize the following guidelines and one of the available software packages used to model doses to members of the general public:

18.2.1 NUREG 1507, Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions (http://techconf.llnl.gov/radcri/1507.html)

18.2.2 MARSSIM, the Multi-Agency Radiation Survey and Site Investigation Manual. (http://www.epa.gov/radiation/marssim/)

18.2.3 The D&D version 2.2 or RESRAD software which is a comprehensive, integrated software program used to calculate the Total Effective Dose Equivalent to persons who occupy former restricted areas.

18.2.4 Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in these documents. A

reasonable effort will be made to minimize the contamination prior to use of any covering.

18.3 Prior to vacating a licensed installation which may have been contaminated with radioactive material as a result of licensed activities, we will notify the California Department of Public Health in writing at least 30 days prior to vacating. The installation shall be decontaminated to a degree consistent with subsequent use as an uncontrolled area as specified by the department.

18.4 Chapman will ensure that prior to terminating a license or release of any portion of a facility from licensed activities we will obtain approval from California Department of Public Health.

19.0 RECORDS AND REPORTS

19.1 Chapman will maintain records as required by 10CFR20.2101 through 20.2110 and 17 CCR 30293, and keep the following records current and available for inspection by the Department of Health Services, Radiologic Health Branch:

19.1.1 Package Receipts and Surveys

19.1.2 Radioactive Materials Inventory

19.1.3 Radioactive Materials shipments

19.1.4 Area Surveys

19.1.5 Waste Disposal

19.1.6 Sanitary Sewer Releases

19.1.7 Instrument Calibrations

19.1.8 Dosimetry (if used)

19.1.9 Training Sessions/Attendees

19.1.10 LLRW Reports

19.1.11 Annual Program Reviews

19.1.12 License and related correspondence

19.1.13 State Inspection and Notices of Violations

19.2 Reports will be prepared in accordance with 10CFR20.2201 through 20.2205 as applicable.

19.3 Records and reports will be legible throughout the specified retention period.

19.4 The record may be the original or a reproduced copy.

19.5 The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period.

19.6 Records, such as letters, drawings and specifications, must include all pertinent information, such as stamps, initials, and signatures. The RSO will ensure adequate safeguards of records against tampering and loss.

19.7 If dosimetry is issued records of dosimetry results and declaration of pregnancy will be treated as confidential personnel information and access restricted to the records accordingly. Requests for dosimetry records will be performed in accordance with 17 CCR 30255.

20.0 PROGRAM IMPROVEMENTS & INSPECTIONS

20.1 Chapman will review/audit the content and implementation of the radiation safety program annually and document the results.

20.2 If deficiencies are identified the RSO will ensure corrective actions are implemented.

20.3 The review will include equipment, procedures, records and inspection findings.

20.4 The RSO will determine if any adverse trends are present and if any modifications to the program are required.

20.5 California Department of Public Health Radiologic Health Branch may inspect the facilities at any time unannounced. Inspections are typically every 5 years. If Notices of Violation (NOVs) are received the RSO will ensure the NOV and the response to the NOV are posted within 2 days of receipt or dispatch and remain posted for at least five days or until corrected, whichever is longer.