
	SOP-110 (Ver. 4) Radiation Safety Program
Standard Operating Procedure (SOP)	Effective: 1/25/2022 Supersedes: 11/02/2020
Approved By: James D. Herberg General Manager 	

I. Purpose

The Orange County Sanitation District (OC San) is committed to providing a safe and healthful work environment for all employees. Radiation Safety Program (RSP) is a critical element in the success of OC San's overall safety program. Compliance with this program and procedures is crucial to the safety of OC San employees and contractors. The importance of following the RSP must be understood by all employees charged with the responsibility of working with and around nuclear gauges and gas chromatographs containing radioactive material.

The OC San has developed the RSP in accordance with the California Occupational Safety and Health Administration (Cal OSHA) and the California Department of Public Health (CDPH), Radiological Health Branch regulations found in Title 17, California Code of Regulations (CCR), Division 1, Chapter 5, Subchapter 4, Radiation. This RSP applies to all OC San employees, contractor service representatives, and visitors who enter posted areas where radioactive materials are located. The application of the required practices and procedures to protect employees from exposure to radiation has also been included in this program.

The OC San maintains a zero-tolerance position for any OC San employee who fails to comply with this program. Disciplinary actions up to and including termination will be enforced on employees who willfully and knowingly disregard the safety requirements of this program.

II. Program Administration

This RSP shall be evaluated annually by the OC San Radiation Safety Officer (RSO), to ensure that it is effective in providing adequate protection from hazards associated with performing work activities near the nuclear gauges. This evaluation can be conducted concurrently with the annual audit discussed in Section IX. The RSO shall determine if regulations or national consensus standards have changed since the last annual program review and update the program if necessary. These include:

- California Department of Public Health, Radiologic Health Branch
- NRC Regulations
- Vega Americas General License Requirements

III. Definitions

As Low As Reasonability Achievable (ALARA): The safe work practices that keep exposures to ionizing radiation "as low as reasonably achievable" (ALARA) to minimize exposure to ionizing radiation while performing service or maintenance work on or near nuclear density

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gauges and gas chromatographs, or in an emergency event such as a nuclear density gauge dislodgment.

Authorized User: Personnel who have been authorized by the CDPH Services Radiological Health Branch, an Agreement State, or the U.S. Nuclear Regulatory Commission (NRC) to perform nonroutine operations (e.g., gauge installation, maintenance, repair, disposal) and have adequate training and experience.

Controlled Area: An area outside a restricted area, but inside the site boundary, access to which can be limited by the licensee for any reason.

Curie: A unit used to measure the intensity of radioactivity or radiation producing

Gauge Users: Individuals (OC San employees and contractors) who use nuclear density gauges.

Radiation Safety Officer (RSO): An individual who is qualified by reason of training and experience to oversee the radiation safety aspects of radioactive material use in the institution.

Rad (radiation absorbed dose): the amount of energy / radiation absorbed per unit mass of material. An absorbed dose of 1 rad means that 1 gram of material absorbed 100 ergs of energy.

Radiation (ionizing radiation): Gamma rays and X-rays; alpha and beta particles, high-speed electrons, neutrons, protons, and other nuclear particles; but not sound or radio waves, or visible, infrared, or ultraviolet light.

Radioactive Material: means any material which emits radiation spontaneously.

Rem (Roentgen equivalent man): a measurement of a person's biological risk of suffering health effects from an exposure to radiation.

Restricted Area: An area to which access is limited by the district for the purpose of protecting individuals against undue risk from exposure to radiation and radioactive materials.

Radiation Area: An area accessible to individuals in which radiation levels could result in an individual receiving a dose in excess of 5 millirems in 1 hour at distance of 1 foot from the radiation source or from any surface that the radiation penetrates.

High Radiation Area: An area accessible to personnel or a major part of their body in which radiation levels could result in an individual receiving a dose more than 100 millirems in 1 hour at a distance 1 foot from the radiation source or from any surface that the radiation penetrates.

IV. Responsibilities

A. Radiation Safety Officer

The duties and responsibilities of the RSO are to provide overall coordination of the RSP, including:

- Ensure that the requirements of CCR Title 17, Division 1, Chapter 5, Subchapter 4, Radiation, are implemented.

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- Develop and provide Radiation Safety Awareness training classes for those employees who may be exposed to ionizing radiation emitted by nuclear density gauges. Training may be facilitated through Cornerstone, OC San's training management system.
- Where required, conduct leak tests for equipment containing radioactive materials and shutter mechanism tests on nuclear density gauges that require them every 6 months.
- Ensure the development and maintenance of up-to-date SOPs for Operations, Maintenance, and the Laboratory.
- Ensure proper posters and forms are posted in accordance with regulatory requirements.
- Assist in developing and maintaining up-to-date SOPs for gauge users and emergency operating procedures (EOPs).
- Review and audit Operations and Maintenance (Electrical and Instrumentation) work activities near the source holder to ensure compliance with the SOPs.
- Inspect general condition of the nuclear density gauge and pipe flange connections.
- Act as a liaison by assisting the authorized user(s) from the nuclear density gauge manufacturer.
- Coordinating the removal and relocation of Ohmart ES-3 and SR-1A nuclear density gauges.
- Providing shipping pallets and or containers, affixing the nuclear density gauges to shipping pallets and or containers, and providing temporary storage for nuclear density gauge(s) scheduled for disposal.
- Procure and maintain service contracts for the calibration and maintenance of radiation survey instruments.
- Establish and maintain secure storage facilities for sources not in service.
- Ensure that general license, source identification activity, and serial and model number plates are attached to the equipment as applicable.
- In coordination with the Safety and Health Supervisor, act as a liaison by assisting supervising representative from the California Department of Public Health, Radiological Health Branch when equipment containing radioactive materials is to be disposed of or relocated, when required.

V. Procedure

The OC San has two sources of radiation in use at the Plant One facility:

- Three sludge density gauges are located inside the pump rooms of Primary Sedimentation Basin (PSB) 1 – 5 pump rooms. Two density gauges are in PSB Pump Room 1-2 & 5, and one density gauge is in PSB Pump Room 3-4. The three sludge density gauges contain Cesium-137 gamma radiation sources ranging from 500 to 1500 millicuries.
- Two Nickel-63 beta radiation sources housed within one gas chromatograph machine located in the Laboratory. Each Nickel-63 source is 15 millicuries.

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Annual radiation doses from these radiation sources are well below the allowable 5,000 millirem to a whole body per year set by the NRC.

To keep employee exposure to radioactive sources ALARA and maintain compliance with the US NRC and Cal OSHA, the OC San developed this RSP that contains general requirements to protect OC San employees who are gauge users. General requirements are as follows:

- OC San shall develop equipment specific standard operating procedures (SOPs) for all types of equipment that contain radioactive materials.
- OC San shall designate qualified personnel to assume the duties of RSO and Assistant RSO.
- OC San shall ensure that both the RSO and the Assistant RSO have enough knowledge to develop and maintain the RSP.
- OC San-owned radioactive materials (nuclear density gauges, smoke detectors and exit signs) cannot be abandoned, sold for scrap, or placed in trash bins.
- Only authorized companies or persons shall repair, maintain, install, or remove equipment containing radioactive materials.
- Any OC San-owned equipment containing radioactive materials slated for disposal shall be shipped only to authorized companies or persons to receive, store, and dispose of radioactive material.
- OC San employees shall immediately report to the RSO the loss, theft, or transfer of OC San-owned equipment that contains radioactive material, failure of, or damage to the shielding or the source containment.
- The RSO in consultation with the Safety and Health Supervisor shall notify the CDPH Radiological Health Branch of any loss, theft, unauthorized transfer of OC San-owned equipment containing radioactive material, failure of, or damage to the shielding or the source containment.
- If there is indication of failure of or damage to shielding or source containment, operation of equipment containing radioactive materials is prohibited.
- All labels on equipment containing radioactive materials shall be maintained on these devices in a legible condition; removal of these labels is prohibited.

VI. Posting, Labeling and Signage Requirements

CCR, Title 17 Section 30255 requires that certain documents, warning signs, and labels be posted in the work area to inform employees of their rights and to make them aware of the potential exposure to ionized radiation. The RSO shall ensure that the following documents are posted in a sufficient number of places to permit employees engaged in work under the licenses to review them on the way to or from any work location. The postings shall be replaced if damaged or altered.

- Conspicuously post a current copy of CDPH Form RH-2364 (Notice to Employees) in a sufficient number of places to permit individuals working in or frequenting any portion of a controlled area to observe a copy on the way to or from such area.
- Conspicuously post a current copy of CCR Title 17, Division 1, Chapter 5, Subchapter 4, Radiation, in the work areas where licensed radioactive materials are used. If posting of

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the regulations is not practicable, a notice, which describes the document and states the location where it may be examined, shall be posted.

- SOPs and EOPs applicable to work with sources of radiation shall be posted in the work areas where licensed radioactive materials are used. If posting of the SOPs or EOPs is not practicable, a notice, which describes the document and states the location where it may be examined, shall be posted.
- A copy of applicable licenses for radioactive material. If posting of licenses is not practicable, a notice, which describes the document and states where it may be examined, shall be posted.
- Notice of Violations (NOV) involving radiological working conditions, or any order issued pursuant to CCR shall be posted within two working days after receipt of the documents from the California Department of Public Health; the OC San's response, if any, shall be posted within two working days after dispatch by the OSCD. Such documents shall remain posted for a minimum of five working days or until action correcting the violation has been completed, whichever is later.

The RSO shall ensure that "Caution Radioactive Materials" labels are attached to each nuclear density gauge.

- Employees are not to remove or deface labels.
- Employees are to report damaged or missing labels to the RSO when discovered.

The RSO shall ensure that areas are properly identified with the applicable signage listed below. Plant One areas where nuclear gauges are located are found in Attachment 1 Radioactive Material Inventory.

- Restricted Area
- Radiation Area
- High Radiation

VII. General License Requirements

This section presents the various requirements of the nuclear density gauges permitted under a general license. The OC San operates nuclear density gauges under a General License issued by the California Department of Public Health, Radiological Health Branch per 17 CCR 30192.1. OC San must comply with the requirements of the CCR Title 17 Division 1, Chapter 5, and Subchapter 4, Radiation. OC San shall ensure that the following general requirements are met:

- OC San-owned nuclear density gauges cannot be abandoned, sold for scrap, or placed in trash bins.
- Only authorized companies or persons shall remove nuclear density gauges.
- Any OC San-owned nuclear density gauge slated for disposal shall be shipped only to authorize companies or persons to receive, store, and dispose of radioactive material.
- Under the supervision of an authorized user, OC San maintenance employees may remove or install a nuclear density gauge provided that the ON-OFF mechanism (shutter) is locked and tagged out in the OFF position.

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- Only authorized users shall perform any dismantling, repairing, and testing involving a nuclear density gauge's radioactive material, its containment, or shielding.
- Newly installed nuclear density gauges shall be tested for radioactive leakage and the proper functioning of the ON OFF mechanism (shutter) by authorized users.
- OC San employees shall report immediately to the RSO the loss, theft, or transfer of district-owned nuclear density gauges, failure of, or damage to the shielding or the source containment.
- The RSO, in consultation with the Safety and Health Supervisor, shall notify the California Department of Public Health Radiological Health Branch of any loss, theft, unauthorized transfer of district-owned nuclear density gauges, failure of, or damage to the shielding or the source containment.
- If there is indication of failure of or damage to shielding or source containment, operation of nuclear density gauges is prohibited.
- Nuclear density gauge General License labels shall be maintained on these devices in a legible condition; removal of these labels is prohibited.

VIII. Training Requirements

Annual training is required for gauge users who work in or frequent any portion of a controlled or restricted area where the storage, transfer, or use of radioactive materials occurs. OC San personnel who are required to receive Radiation Safety training are:

- Instrumentation and Electrical (Division 870)
- Plant Mechanical Maintenance (Division 870)
- Plant Operations (Division 830)
- Plant Facilities Maintenance (Division 870)
- All contractors who work on or near nuclear density gauges must show proof of training prior to working with these gauges.

Specific training topics to be covered in the training are:

- Components and operation of Ohmart Nuclear Density Gauges.
- Purposes and functions of Ohmart Nuclear Density Gauges protective devices.
- Types of radioactive sources within the OC San facilities.
- Location of Radioactive sources within the OC San facilities.
- Cal OSHA, CDPH Title 17 and Vega Americas General License Requirements.
- Amounts of radiation exposure allowed by the U.S. NRC regulation.
- Potential amount of exposure received by district personnel.
- Personnel monitoring.
- ALARA principles of radiation safety awareness.
- Posting, signage, and labeling requirements.

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- Training requirements.
- Recordkeeping requirements.
- Operating procedures.
- Emergency procedures.

IX. Program Audit Requirements

The RSP shall be audited annually and documented using the Radiation Program Audit Form. The audit form is an available questionnaire located in Cority, OC San's incident management software system. All items identified in the audit shall be corrected as soon as possible and no longer than 90 days from the finding. Audit findings shall be reported to the Safety and Health Supervisor and the RSO.

X. Limitations on User Activities and Required Procedures

Per the Vega Americas General License Requirements, OC San gauge users are limited in the scope of activities that may be performed on density gauges. The following cannot be performed by OSCD gauge users and can only be performed by an authorized Specific Licensee (e.g., an authorized user from the Vega Americas).

- Preparation for removal and installation of nuclear density gauges
- Unlocking the shutter and turning it ON.
- Testing proper operation of the shutter and shutter position indicator.
- Making the initial radiation field intensity survey.
- Performing initial testing for leakage of radioactive material.
- Removing the device from its mounding.
- Removal and installation of nuclear density gauges.
- Dismantling the device.
- Transporting nuclear gauges from storage to installation site and vice versa.
- Packaging nuclear gauges in preparation for shipping to disposal site. Packaging also includes application of required DOT labeling.

Maintenance activities that can be performed by OSCD gauge users are:

- De-energize, disconnect, or reconnect electrical wiring to the density detectors during the removal and installation of Ohmart ES-3 and SR-1A nuclear density gauges.
- Perform calibration checks and adjustments on Ohmart ES-3 and SR-1A nuclear density gauge detectors
- Perform preventive maintenance on connected piping and gauge sludge flow bypass and isolation valving.
- Apply paint to Ohmart ES-3 and SR-1A nuclear density gauges.

The following Laboratory activities that can be performed without supervision of a specific licensed representative are:

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- Start up and shut down of gas chromatographs.
- Installation and removal of Varian and Shimadzu gauges.

XI. Occupational Dose

An occupational dose is the dose received by an individual in the course of employment in which the individual's assigned duties involved exposure to radiation or radioactive material from a licensed source.

OC San employees who work with or on nuclear density gauges are gauge users.

The maximum total effective dose allowed for a gauge user under the US NRC and the California Dept of Radiological Health regulations is 5,000 millirem or 5 rem per year excluding exposure to background radiation and from medical procedures.

OC San shall provide reports to any individual of their radiation exposure data and the results of any measurements, analyses, and calculations of radioactive material deposited or retained in the body of that individual as specified in Title 17 California Code of Regulations Section 30255. The information reported shall include data and results obtained pursuant to Department regulations, orders, or license conditions, as shown in records maintained by the user pursuant to California Department of Public Health regulations. Each notification and report shall: be in writing; include appropriate identifying data such as the name of the user, the name of the individual, the individual's Social Security number; include the individual's exposure information; and contain the following statement:

This report is furnished to you under the provisions of the California State Department of Public Health Regulations: Standards for Protection Against Radiation. You should preserve this report for future reference."

These reports shall be provided as follows:

(A) Each user shall advise each worker annually of the worker's dose as shown in records maintained by the user pursuant to title 10, Code of Federal Regulations, part 20, (10 CFR 20), section 20.2106 as incorporated by reference in section 30253. The user shall provide an annual report to each monitored individual pursuant to section 20.1502, incorporated by reference in section 30253, of the dose received in that monitoring year if:

1. The individual's occupational dose exceeds 100 mrem total effective dose equivalent or 100 mrem to any individual organ or tissue; or
2. The individual requests his or her annual dose report.

(B) At the request of a worker formerly engaged in work controlled by the user, the user shall furnish to the worker a report of the worker's exposure to radiation or radioactive material as shown in records maintained by the user pursuant to 10 CFR 20, section 20.2106 that has been incorporated by reference in section 30253, for each year the worker was required to be monitored pursuant to section 20.1502 and for each year the worker was required to be monitored under the monitoring requirements in effect prior to March 3, 1994. Such report shall be furnished within 30 days from the time the request is made, or within 30 days after the exposure of the individual has been determined by the user, whichever is later. This report shall cover the period that the worker's activities involved exposure to radiation from radioactive

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material licensed by, or radiation machines registered with, the Department and shall include the dates and locations of work under the license or registration in which the worker participated during this period.

(C) When a user is required pursuant to 10 CFR 20, sections 20.2202, 20.2203, or 20.2204, as incorporated by reference in section 30253, to report to the Department any exposure of an individual to radiation or radioactive material, the user shall also provide the individual a report on his exposure data included therein. Such reports shall be transmitted at a time not later than the transmittal to the Department.

(D) At the request of a worker who is terminating employment with the user that involved exposure to radiation or radioactive materials, during the current calendar quarter or the current year, each user shall provide at termination to each worker, or to the worker's designee, a written report regarding the radiation dose received by that worker from operations of the user during the current year or fraction thereof. If the most recent individual monitoring results are not available at that time, a written estimate of the dose must be provided together with a clear indication that this is an estimate.

The OC San Risk Management Division goal is to keep employee exposures below the maximum allowed for the public which is 100 millirem per year excluding exposure to background radiation and from medical procedures.

Ohmart ES-3 and SR-1A nuclear gauge density detectors are equipped with a Cesium-137 radioactive sources what have an activity of 500 to 1,500 millicuries (mCi) or 0.5 to 1.5 Curies (Ci). Cesium-137 emits gamma radiation. For this reason, the ES-3 and SR-1A nuclear gauges are equipped with lead and steel shielding. The shielding reduces the amount radiation being emitted from the gauge down to a field of less than 5 millirem per hour at one foot from the gauge.

OC San will use the ALARA principle to protect and minimize its gauge users and employees from exposure to gamma radiation emitted by Cesium-137. ALARA can be achieved by training OC San gauge users how to minimize their exposure to gamma radiation using time, distance, and shielding. OC San Gauge users can minimize their exposure to radiation by doing the following:

- Pre-plan their work activities.
- Set up and stage tools, meters, and other maintenance equipment a minimum 3 feet from the gauge.
- Close the shutter on the SR-1A nuclear gauge to protect the gauge user from the radiation beam when replacing electronics or calibrating the detectors.
- For ES-3 gauges which are not manufactured with a shutter; insert a metal blocking device into the gap between the source holders and detector, to perform the same function as a shutter and protect the gauge user from the radiation beam when replacing electronics or calibrating the detectors.
- Leave the area after the maintenance or calibration work is completed.

A. Prenatal Exposure

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NRC regulation 10 CFR 19.12 Instruction to Workers requires instruction in the health protection problems associated with exposure to radiation and/or radioactive material, including to an embryo/fetus (NRC Regulatory Guide 8.13).

Women, whose job requires them to work around sludge density gauges, are not required by law to notify their supervisors that they are pregnant. However, the OC San Safety and Health Division recommend that they do so.

If a pregnant woman decides to declare her pregnancy, she will be required to fill out a Declaration of Pregnancy form. This form can be retrieved from the OC San RSO. Once the form has been signed by the employee declaring pregnancy, it will be the responsibility of the OC San Risk Management Division and her immediate supervisor to ensure that the radiation dose to an embryo or fetus during the entire pregnancy does not exceed 0.5 rem or 500 millirem.

To accomplish this, the employee's work assignment will be modified to restrict her from performing work in process areas where nuclear devices are located, primarily inside Plant One PSB 1, 2, and 5 pump room and PSB 3-4 pump room. The work restriction shall remain in effect until she withdraws the Declaration of Pregnancy in writing. If the Declaration of Pregnancy is not withdrawn, then the written declaration may be considered expired one year after submission.

B. Radiation Safety Officer

The occupational exposure for the RSO is estimated the gauge survey and leak test. Annual radiation dose is estimated as follows:

- The time spent near the nuclear gauges is approximately 10 minutes per gauge x 3 nuclear gauges at Plant One = 30 minutes of total time.
- The radiation field at one foot from the density gauge is 5 mR per hour.
- 30 minutes = 0.5 hours x 5 mR/hour = 2.5 mR, Wipe test are conducted every six months or twice per year $2 \times 2.5 \text{ mR} = 5.0$ millirem per year.
- The RSO also performs a leak test on the two Nickel-63 sources located in the laboratory gas chromatograph. The activity of each Nickel-63 source is 15 mCi. Nickel-63 is a low-energy beta emitter and not an external exposure hazard, as discussed below.

C. Laboratory Personnel

Laboratory personnel who work with gas chromatographs may be exposed to beta radiation emitted from a Nickel 63 isotope. Unlike gamma radiation, beta radiation requires minimal shielding to protect the user from radiation exposure. Because the Electron Capture Detector (ECD) Nickel 63-sources are housed inside the gas chromatographs which shield the beta radiation, the risk of radiation exposure is minimal, less than 2 millirem per year. The OC San RSP requires the following practices when handling ECD devices.

- OC San laboratory personnel who handle ECD devices shall use either disposable light cotton or latex gloves when handling the detectors.
- Thoroughly wash your hands after handling ECD devices.

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D. Instrumentation Technicians

Calibration of OC San nuclear density gauges is assigned to Instrumentation personnel; this activity involves both working within one foot or less from the source holder. The annual radiation dose that a Plant One Instrumentation Technician may receive was estimated based on records of preventative maintenance and annual calibration records:

- The average time per year that a Plant One Instrumentation Technician spends at one foot or less from nuclear gauges is 12 hours. The radiation exposure rate at one foot or less from the nuclear density gauge is 5 millirem per hour.
- The estimated annual radiation dose is 12 hours x 5 mR per hour, or 60 millirem per year.
- ES-3 Ohmart density gauges are not equipped with a shutter, it is imperative that the Instrumentation Technician verify that metal blocking device is inserted into the space between the source holder and detector when working on or replacing the electronics or circuit boards to the detector. Failure to install the radiation beam blocking device will result in the Instrumentation Technician receiving a much higher dose of radiation.

E. Plant Operators

Plant Operators who are assigned to complete rounds inside Plant One PSB 1, 2 & 5 pump room and PSM 3-4 pump room are required to pump scum once per shift. This work requires the operator to complete density gauge bypass set ups on the Primary Basins sludge transfer line. This may require the operator to stand in an area that is approximately one foot distance from the nuclear gauge. Bypass setup takes approximately 2 minutes to complete. The annual radiation dose rate for a Plant One Operator was calculated using the following information.

- Source holder radiation activity, distance of one foot 5 mR per hour.
- Total number of operational density gauges located at Plant One is 3.
- Total time spent by an Operator at one foot from the source holder while performing the valuing set up is approximately 5 minutes.
- Frequency or estimated amount of times that a Plant One Operator will be assigned to the primary basin area is 4 shifts per month or 48 shifts per year.
- 48 shifts per year x 3 density gauges per shift x 5 minutes valuing set up = 720 minutes per year, or 12 hours per year
- 12 hours x 5 mR = 60 millirem per year

F. Contractors and Service Providers

It will be the responsibility of the OC San RSO to ensure that radiation exposures to Contractor and Service Providers are kept below the dose limit for a member of the public of 100 millirem per year or 2 millirem per hour, excluding exposure to background radiation and from medical procedures.

This goal can be accomplished by informing Contractors and Service Providers of the following:

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- The locations within the Plant One process facility where radioactive materials are kept and used.
- General License safety rules, ALARA practices, and EOPs.

General license safety rules shall be strictly adhered to, failure to comply will result in contractor of service provider personnel being denied access into the process area where the nuclear gauges are located. At no time will contractors and service providers be allowed to do the following:

- Removal or modification of existing labels or signs that are affixed to the nuclear gauge.
- Removal of locks, lockout and tagout devices applied the nuclear gauge or associated pipe or drain valves.
- Dismantling and or removal of electrical components associated with OC San owned nuclear gauges.
- Dismantling any piping that supports the nuclear gauge.
- Performing hot work activities, less than two feet from an OC San owned nuclear gauge.

Additionally, the following are required:

- Removal, relocation, or reinstallation of an OC San owned nuclear gauge shall be done under the supervision of both the OC San RSO and an authorized Specific Licensee (e.g., an authorized user from the Vega Americas).
- Transport of an OC San owned nuclear gauge from its original location to a temporary storage area shall be done under the supervision of both the OC San RSO and an authorized Specific Licensee (e.g., an authorized user from the Vega Americas).
- Calibration and maintenance work on OC San owned nuclear gauges can only be done by trained OC San instrumentation technicians.
- Contractor and Service providers must contact the OC San RSO prior to bring any radioactive devices on to OC San property.
- Contractors and Service providers shall also inform the OC San RSO of the dates and locations of where these device(s) are to be used within the OC San Facilities.
- Contractors and Services Providers shall provide a list of contact personnel who will be both operating the devices that contain radioactive material and those responsible for the security of these devices.
- Contractor and Service Providers shall post the appropriate warning signs and barricade the area where radioactive material is used.
- Contractor and Services Providers will not be allowed to store nuclear devices on OC San property. All radioactive materials shall be removed from OC San property at the end of each workday.

XII. Emergency Procedures

Steps to be taken in the event of a gauge theft, damage to the source holder that has occurred due to dislodgment (fall), collision, fire, explosion, are covered in this section.

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The Cesium-137 sources that are used in the density gauges emit gamma radiation. Provided the source holder's steel outer shell and the lead (shielding) remains intact, the radiation exposure and dose are less than 5 mR per hour at one foot from the source holder. If the gauge becomes dislodged due to a fire or explosion, it is highly likely that the source holder shielding will be damaged. However, damaged shielding will substantially increase the radiation exposure rate around the gauge. The radiation exposure rate of an unshielded 1,500 mCi source of Cs-137 is approximately 5,400 mR per hour at one foot. Employees or contractors who are unaware of the potential hazard could receive a radiation dose that exceeds the maximum annual dose allowed for a gauge user of 5,000 millirem, if the gauge user stands a distance of one foot or less from the unshielded source for about an hour.

In all emergency procedures, priority is given to human safety. In doing so certain essential steps must be taken, these steps are divided into two types of responses: 1) the Initial Response and 2) the Secondary or RSO Response. It is the responsibility of a (trained) OC San employee who discovers emergency situations to initiate the Initial Response.

A. Secondary Response will be the responsibility of the RSO, including:

- Contain the radioactive materials at the site of the emergency by denying access to unauthorized personnel.
- Shut down area ventilation fans and air conditioning (if applicable).
- Limit access to the scene of the incident and areas exceeding 2 mR/hr. Where the radiation levels are 2 mR/hour, post radiation hazard signs and limit access by using rope, barricades, or similar.
- Notify the appropriate authorities promptly, including the local fire department, California Department of Public Health Radiological Health Branch, and the Vega Americas RSO. Seek their immediate advice on additional steps or precautions that need to be taken.
- Arrange for immediate arrival of experts who are trained and authorized to deal with such accidental conditions.
- Maintain complete records of the accident and follow-up procedures.

B. Source Holder Lost or Theft

The employee who discovers a missing source holder shall notify the RSO immediately. The RSO shall immediately notify the California Department of Health Radiological Health Branch and organize the search for the source-holder or the source capsule. To initiate the search the RSO shall complete the following:

- Use a survey meter on the lowest scale during the search.
- Look for any unusual radiation readings that are higher than background readings.
- Check places where the source could be hidden from view.
- Look through trash dumpsters, scrap bins, dumping areas, bone yards, Warehouse, and trucks.
- Check with contractors working in the areas, if any.

If the missing source holder or source capsule is found, the following shall be implemented:

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- Evacuate the immediate area.
- Regulate entry to the location where the gauge or source capsule was found.
- Where the radiation levels are 2 mR/hour, post radiation hazard signs and limit access by using rope, barricades, or similar.
- Notify the appropriate authorities promptly.
- Arrange for the immediate arrival of experts who are trained and authorized to deal with these situations.
- Collect and maintain complete records of the incident and follow-up procedures.

C. Damaged Source Holder

An employee who discovers a damaged source holder shall complete the following:

- Notify the RSO immediately.
- Evacuate all personnel from the immediate area.
- Cordon off and deny access into the area.
- Notify other employees in the immediate area of the hazard.
- Help the RSO identify all persons or employees who were in the area and or involved in the accident that dislodged and or damaged the gauge.

The RSO shall conduct radiation measurements around the source-holder; the exposure rate should be less than 5 mR/hour at one foot from the gauge. If the exposure rate is 5 mR/hour or less, the shielding around the source is probably not damaged.

If the exposure rate around the source holder is 5 mR/hour or less at one foot, RSO shall the perform the following:

- Without moving the gauge, complete a visual check of the source-holder, check for dents, cracks, and splits welded seams.
- Ensure that the shutter on or off mechanism is functioning properly. If it is and the source holder is equipped with a shutter, lock the shutter in the off position. Older Ohmart ES-3 Gauges do not have a shutter.
- Make sure that the radiation beam is pointed away from any entry exit points or other areas where personnel may be exposed to the beam. On ES-3 gauges, block the opening with shielding material.
- Check for possible radioactive material leakage by performing a wipe test on the gauge.

If the exposure rate around the source holder exceeds 5 mR/hour at one foot or it appears that the source-holder steel outer casing or lead shielding has been damaged, the RSO shall:

- Limit access to the area. Where the radiation levels are 2 mR/hour, post radiation hazard signs and limit access by using rope, barricades, or similar.
- Obtain names of individuals who may have been exposed to higher than normal levels of radiation. Immediately notify the California Department of Public Health Radiological Health Branch and inform them of the situation.

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- For your records, write down the name of the person at the agency you spoke with.
- Contact the gauge manufacturer and arrange for the safe removal, packaging, and shipment of the source holder.
- Maintain complete records of the accident and follow-up procedures.

D. Fire

In the event of a fire in the area where a nuclear gauge is located, the first responder shall complete the following:

- Call the 2222 emergency telephone number and alert the Control Center Operator to call out the fire department.
- Cordon off and deny access into the area until the fire department arrives.
- Notify the RSO immediately.
- Request that an employee be sent to the front gate to escort the fire department to the location of the fire.
- The RSO will inform fire-fighting personnel that a radioactive device is in the area.
- Establish and maintain a radiation safety perimeter or zone, by conducting a radiation survey of the affected area. Where the radiation levels are 2 mR/hour, post radiation hazard signs and limit access by using rope, barricades, or similar.
- Note names of OC San personnel who were in the affected area when the fire was discovered. Estimate the length of exposure and radiation dose received by these individuals.
- Immediately notify the California Department of Public Health Radiological Health Branch.
- Contact the gauge manufacturer and arrange for the immediate arrival of experts who are trained and authorized to deal with such accidental conditions.
- Assist the experts in the safe removal, packaging, and shipment or disposal of the damaged source holder.
- Maintain complete records of the accident and follow-up procedures.

E. Source Holder Stuck Shutter

An employee who discovers a stuck shutter must stop work, leave the gauge in place, and immediately notify the RSO. The RSO must perform the following:

- Leave the gauge in place.
- Place do not operate tag on shutter mechanism and attach a lock.
- Contact Vega Americas for advice. They will advise whether the gauge should be shipped back to them or if a field engineer should be sent out from Vega Americas to repair it.
- Notify the California Department of Public Health Radiological Health Branch within a 24-hour period and submit a written follow-up report within 30 days.

Subject: **Radiation Safety Program**

XIII. Emergency Equipment

The RSO is responsible for having the necessary emergency equipment on-hand for a potential emergency involving a nuclear gauge. A list of emergency equipment is provided below:

- List of emergency procedures and phone numbers.
- Survey meter.
- Leak test kits.
- Danger tape, rope, or similar (to isolate the area)
- Radiation hazard signs (to identify the area)
- Batteries for survey meters.
- Tape measure.
- Gloves.
- Shielded containers.

XIV. Recordkeeping

Federal and state regulations require that specific records be kept on file for each nuclear device on site. Requirements for all these records are as follows:

- The records may be an original or a reproduction copy.
- Records such as letters, drawings, and specifications shall include all pertinent information such as letters, stamps, initials, and signatures.
- Adequate measures shall be implemented to safeguard records from being tampered with or lost.

Required Records that must be maintain for a period not less than 3 years are:

- Nuclear density gauge calibration maintenance records.
- Leak test records.
- Radiation survey meter calibration records.
- Employee training records.

Notification letters sent to the California Department of Public Health Radiological Health Branch related to:

- Receipt, installation, relocation, and disposal of nuclear density gauges.
- Incidents such as damage to or malfunction of fixed nuclear density gauges, fire loss, or theft.
- Possible exposure of an employee to a radiation level that exceeds the NRC maximum amount allowed for a gauge user.
- Transfer of ownership records when a nuclear density gauge is returned to the manufacturer for disposal.
- Shipping manifest completed by trucking company that transports the nuclear density gauge.
- Up-to-date inventory of all on-site nuclear density gauges.

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All records created or generated in the course of this procedure shall be legible and stored in a way that they are readily retrievable in facilities or electronic document/content management systems that provide a suitable environment to prevent damage, deterioration, or loss. Records may be in the form of any type of media, such as hard copy or electronic media. The OC San Records Retention Schedule is the official procedure governing the retention, retirement, and destruction of District records. Document owners should use these schedules to determine the item and series that best fit their records. Document owners are responsible for ensuring that documents are properly marked, indexed, and filed for their projects or area of responsibility.

XV. References

California Code of Regulations, Title 8 Section 5076, Administrative Procedure (Standards for Protection Against Radiation).

California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4, Radiation.

California Department of Public Health Form RH-2364 (Notice to Employees).

NRC Regulatory Guide 8.13. Instruction Concerning Prenatal Radiation Exposure. June 1999.

NUREG-1556 Volume 4. Consolidated Guidance About Materials Licenses. Program-Specific Guidance About Fixed Gauge Licenses. Revision 1. July 2016.

Vega Americas General License Requirements.

XVI. Revision History

Version	Date	By	Reason
0	06/26/2003	Patrick Carnahan	
1	01/05/2011	Patrick Carnahan	
2	04/16/2019	Alison Wilding, CIH (Arcadis)	Program update
3	08/20/2020	John Frattali	Periodic Update – Refer to Program Change Log
4	12/07/2021	Brian Huynh	Annual Program Review – Refer to Program Change Log

XVII. Attachments

Attachment 1. Radioactive Materials Inventory

Attachment 1
RADIOACTIVE MATERIALS INVENTORY

PLANT NO 1 PRIMARY SEDIMENTATION BASIN (PSB) PROCESS AREAS:

<u>LOCATION</u>	<u>MNFCTR*</u>	<u>MODEL</u>	<u>ISOTOPE</u>	<u>ACTIVITY</u>	<u>S/N</u>
PSB 1&2	Ohmart	SR-1A	Cs-137	500 mCi	48186
PSB 3&4	Ohmart	ES-3	Cs-137	1500 mCi	68074
PSB 5	Ohmart	ES-3	Cs-137	1200 mCi	70625