


<b><i>HEALTH AND SAFETY MANUAL</i></b>	
Title: Ionizing Radiation	
Approved by: Greg Savoy	Rev. 3/1/13

## **1.0 Purpose**

The purpose of this safety policy is to establish guidelines for the protection and safety of Compay employees who have exposure to occupational ionizing radiation.

## **2.0 Scope and Applicability**

Radiation is a form of energy. Ionizing radiation causes very damaging effects to skin tissue and can initiate precursors to several forms of cancer. For most employees, the possibility of being exposed to a radiation source is rare.

This safety policy provides guidelines for the safe handling of ionizing radiation. It includes provisions for training and the necessity for restricted area warning signs. Additionally, it includes discussion on the monitoring of personnel for ionizing radiation exposure and the reporting of ionizing radiation overexposure. This document also details the areas of responsibility for managers, supervisors, employees

This safety policy affects any employee who as a result of his or her job duties will handle, use, calibrate, maintain, operate, test, or monitor equipment, materials or products that produce or contain ionizing radiation sources.

## **3.0 Reference**

This safety policy is established in accordance with Occupational Safety and Health Standards for General Industry (29 1910CFR 1910.1096) and Occupational Safety and Health Standards for Construction Industry (29 CFR 1926.53).

## **4.0 Policy**

It is the policy of Point Eight Power, Inc. to provide a place of employment that is free from recognized hazards that cause or are likely to cause death or physical harm to employees or the public. Therefore, unauthorized handling of radiation sources is strictly prohibited. When radiation hazards exist that cannot be eliminated, then engineering practices, administrative practices, Personal Protective Equipment (PPE), safe work practices, and proper training regarding Ionizing Radiation will be implemented. These

measures will be implemented to minimize those hazards to ensure the safety of employees and the public.

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## 5.0 General Responsibilities

It is the responsibility of each manager, supervisor and employee to ensure implementation of Company's ionizing radiation safety policy. It is also the responsibility of each employee to immediately report any unsafe act or condition to his or her supervisor. Specific responsibilities are found in Section 6.3.

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## 6.0 Procedures

This section provides applicable definitions, establishes general processes, and identifies specific responsibilities required by the Company's policy on Ionizing radiation.

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### 6.1 Definitions

**Dose-** The quantity of ionizing radiation absorbed, per unit of mass, by the body or by any portion of the body.

**Film Badge-** A piece of masked photographic film worn like a badge for personal monitoring of whole body radiation exposure. Radiation exposure can be checked by developing and interpreting the film.

**Ionizing Radiation-** Electromagnetic or particulate radiation capable of producing ions, directly or indirectly, by interaction with matter.

**Nuclear Density Gauges-** A piece of equipment with a radioactive source used for density measurements of asphalt, aggregate base course and concrete.

**Radiation-** A form of energy that includes alpha, beta, gamma, x-rays, neutrons, electrons, protons, or other atomic particles. This term does not include sound or radio waves, visible light, infrared or ultraviolet light.

**Radiation Safety Coordinator-** The individual having the appropriate training, management designation and responsibility to maintain and update the radiation license from the Radiation Protection Section.

**Radioactive Material-** Any material which emits, by spontaneous nuclear disintegration, corpuscular or electromagnetic emanations (energy).

**Restricted Area-** Any area to which access is controlled by Reagan Power & Compression, Inc. for purposes of protection of individuals from exposure to radiation or radioactive materials.

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#### 6.2.1 Training

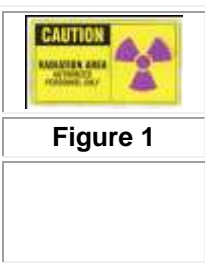
Employees affected by this safety policy shall be identified by supervisors and training provided consistent with the hazard and exposure to ionizing radiation. All individuals working in or frequenting any portion of a radiation area shall be trained to inquire about the presence and levels of radioactive materials in the area. Employees shall be instructed in the safety problems associated with exposure to such radioactive materials or radiation and the precautions to take or devices to use to minimize exposure. They shall be instructed in the applicable provisions of §1910.1096 (ionizing radiation) for the

protection of employees from exposure to radiation or radioactive materials; and shall be advised of reports of radiation exposure which employees may request pursuant to the regulations in this section.

All employees whose work may necessitate their presence in an area covered by an immediate evacuation warning signal shall be made familiar with the actual sound of the signal - preferably as it sounds at their work or jobsite location.

### 6.2.2 Warning Signs

Any facility storing radioactive material in any form or equipment that uses ionizing radiation, shall have signs outside the restricted area notifying employees of the potential dangers. These signs shall contain the standard radiation symbol with the conventional radiation caution colors (magenta or purple on yellow background). **Figure 1** shows a typical radiation protection sign



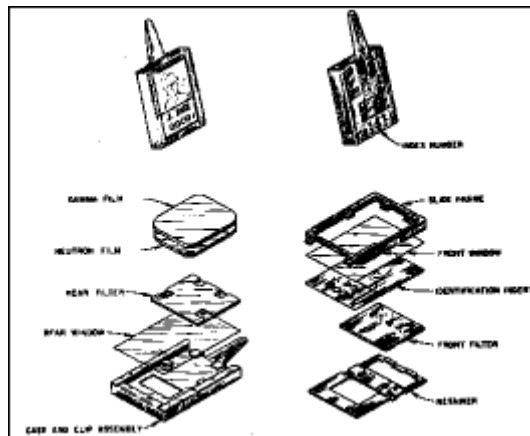
### 6.2.3 Personnel Monitoring

Company will maintain employee exposure records for employees that are required to wear personal monitoring equipment. At a minimum, exposures will be disclosed to employees on an annual basis by his or her supervisor.

All employees who enter a high radiation area and employees that enter a restricted area and receives, or is likely to receive, a dose in any calendar quarter in excess of the applicable values noted in **table 1** shall be provided and use appropriate personnel monitoring equipment, such as film badges, pocket chambers, pocket dosimeters, or film rings.

	Rems per calendar quarter
Whole body: Head and trunk; active blood-forming organs; lens of eyes; or gonads	1 1/4
Hands and forearms; feet and ankles	18 3/4
Skin of whole body	7 1/2
Table 1 (from OSHA 1910.1096(b)(1))	

**Figure 2** illustrates an exploded view of a film badge. These badges are part of a continuous monitoring program and are replaced monthly.



**Figure 2**

### **6.2.4 Recordkeeping**

Company shall maintain records of exposures for employees who are required to wear personnel monitoring devices. Each division /office/program shall disclose exposures to employees upon request from the employee. At a minimum, exposures will be disclosed to employees on an annual basis.

### **6.2.5 Exposure Reporting Procedure**

For employees not protected by the Atomic Energy Commission, all exposures over the allowable threshold limits shall be reported to his or her duly authorized representative. In addition, exposure notification in writing shall be submitted to his or her duly authorized representative within 30 days of the original exposure date. A record of all radiation exposures must be made available to future employers at the request of former Company employees.

### **6.2.6 Emergency Procedures**

Company employees conducting regulatory activities around such sites shall be made aware and trained on the emergency procedures to follow. All employees whose work may necessitate their presence in an area covered by the signal shall be made familiar with the actual sound of the signal; preferable as it sounds in their work location.

## **6.3 Specific Responsibilities**

### **6.3.1 Managers**

Managers will be responsible for identifying any employees affected by this safety policy. Managers will also ensure compliance with this safety policy through their auditing process.

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### **6.3.2 Supervisors**

Supervisors will ensure that affected employees are trained in the safe use and handling of equipment, instruments or sources that contain ionizing radioactive materials. All training will utilize courses recommended by the Radiation Protection section for the affected employees.

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### **6.3.3 Employees**

Employees shall not operate any equipment or conduct regulatory inspections or surveys without the proper training. Employees shall not operate any equipment or instrument which is damaged or in any other way malfunctioning. Employees will immediately inform their supervisor if any unsafe condition occurs (e.g., leaks, damage, theft or misplacement). Additionally, employees shall not remove or otherwise modify any part of any instrument except to perform allowed routine maintenance or service. Employees shall wear their personnel monitoring equipment as prescribed. Employees that work around or with ionizing radiation materials and equipment shall inquire of and follow all safety protocols. Employees conducting surveys on ionizing radiation equipment and materials shall follow all training and safety protocols.

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### **6.3.4 Safety Risk Management**

Safety Risk Management will provide assistance to managers, supervisors, or others as necessary and as resources allow on any matter concerning this safety policy. Safety Risk Management will assist in locating any required training.

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### **6.3.5 Radiation Protection Section**

The training department will supply a list of training resources upon request to train managers, supervisors, and employees on how to perform surveys and how to calibrate any equipment containing radioactive materials. It will provide guidelines for the safe transport of equipment containing radioactive materials.

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## **6.4 Surveys**

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### **6.4.1 Conducting Surveys of Radiation Work Areas**

An important part of radiation safety is routine contamination surveys. The following information will help guide you in performing these surveys.

### **6.4.2 Radiation Contamination**

Radioactive contamination is radioactive material that is someplace other than where you want it. There are two types of contamination - Removable and Fixed. Removable contamination can be wiped off a surface or object, similar to dust on a piece of furniture. To determine if contamination is removable, a wipe test must be performed. Fixed contamination is contamination that is bound, chemically or physically to a surface. This form of contamination can only be detected by a meter survey.

### 6.4.3 Contamination Survey

A contamination survey is an evaluation of work areas, instruments, floors, sinks, faucet handles, telephones, light switches, etc. for the presence of radioactive contamination. There are two types of surveys - wipe test and meter. It's recommended that all surveys be documented.

### 6.4.4 Survey Meter

A survey meter is a portable, handheld, electronic instrument consisting of three components used to detect ionizing radiation. The three elements are a probe, electronics package, and speaker. The probe converts an incident of ionizing radiation to an electric signal that is sent to the electronics package. The electronics package converts the electrical signal to a visual indication on a meter scale of the intensity of the ionizing radiation field. A speaker provides an audible indication in addition to the visual. A "pancake" probe is recommended to detect isotopes that emit beta particles (except  $^3\text{H}$ ). A scintillation probe is recommended for low energy gamma and x-rays.

### 6.4.5 Meter Function Tests

1. Check the battery frequently by using the battery check position on most units.
2. Check the cable connection to ensure it is not defective.
3. Check if the meter is responding to radiation. When not in a radiation field, the reading for a pancake probe should be 30-50 counts per minute or 300-500 counts per minute for a scintillation probe. Then place the meter near a known radiation source and check for a response.

### 6.4.6 Performing a Meter Survey

A meter survey is conducted by slowly passing the probe over the area or object to be surveyed. Be certain to survey at a constant speed - approximately 2 cm/sec. The distance from the surface or object should also be constant. A distance of 1 cm is suggested. Be careful not to contaminate the probe itself. All readings should be recorded. Be certain to record readings as "net" (actual reading minus the background reading).

### 6.4.7 Wipe Tests

A wipe test is simply a check for contamination that can be removed from a surface. To do a wipe test all you need is a piece of filter paper or paper towel. With a gloved hand, rub the paper over the area to be tested. For a quick assessment, one can check this paper with a Geiger-Müller (GM) meter (will detect high energy beta). For a more accurate analysis use a liquid scintillation counter. To test a wipe sample for the liquid scintillation counter, swipe the area as before with filter paper/paper towel and place it in a liquid scintillation vial and add the required amount of environmentally safe scintillation cocktail. Follow the procedures for using the scintillation counter to test the vial. It is also necessary to establish a background level when using the scintillation counter and to do this, follow the above procedure using an unused filter paper. Please be certain that the liquid scintillation counter is set up to count all the isotopes that are used in your laboratory. The amount of contamination is the difference between the count rate of the actual wipe test and the background count rate.

### 6.4.8 Survey Frequency

There are two types of contamination surveys that can be performed after each use of radioactivity. The first survey is a personal survey and must be conducted after handling/using radioactive material before touching areas not used for radioisotopes and before leaving the laboratory. A personal survey uses a standard GM meter to survey

yourself for contamination. One should check gloves, lab coat, shoes, face, and hair to make certain you are not contaminated with residual radioisotopes. If you detected any contamination on your persons, immediately contact the Environmental Health & Safety Office/Radiation Safety Officer.

Once you have completed a personal contamination survey, the second survey involves your work area and equipment used during the experiment. Check the bench top, floor, cabinets nearby, etc. for contamination. Unless you are using 3H, a standard GM survey meter is sufficient. If you are using 3H perform a wipe test survey and perform a liquid scintillation survey and keep a copy of the printout for your laboratory records.

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