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### ATTACHMENTS

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### Introduction

The California Department of Justice, Bureau of Forensic Services uses instrumentation that generate x-ray radiation. These devices are regulated by the California Department of Health Services, Radiological Health Branch (DHS/RHB) and are required to be registered.

The purpose of the Radiation Protection Program is to ensure that employees operating or working in the vicinity of such instruments receive the lowest possible exposure to radiation as

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possible. The instruments are designed to not leak through shielding and protective interlocks, and under normal circumstances will not cause exposure.

The RPP is designed to ensure that employee exposure will be as low as reasonably achievable by ongoing evaluation of the instruments for leakage.

### Program Requirements

#### **Program Responsibilities**

- a. Lab Supervisor
    - i. Ensure employees operating radiation-producing equipment are properly trained on operation of the equipment and document their competency.
    - ii. Ensure such employees have reviewed the BFS RPP and have completed the Safety Training. Keep records of training.
    - iii. Notify Instrument Support and Health and Safety of equipment malfunction.
    - iv. Notify Instrument Support and the Bureau Health and Safety Unit (HSU) when such equipment will be transferred, sold or destroyed.
  - b. Laboratory Safety Officer
    - i. Provide radiation safety training materials (obtained from HSU) for new employees using such instrumentation. Grade exam and provide to employee's supervisor as proof of completion.
    - ii. Ensure "Notice to Employees" sign (attachment #1) and "General Operating Procedures" (attachment #4) are posted next to applicable machines.
    - iii. Ensure a copy of 17 CCR and 10 CFR regulations and this Radiation Protection Program are available in the vicinity of the machine.
    - iv. Ensure machine-operating instructions are stored and available within the vicinity of the machine.
  - c. Laboratory personnel using x-ray producing cabinets
    - i. Review manufacturer's operating instruction
    - ii. Review BFS RPP Policy & Procedure
    - iii. Complete BFS RPP Safety Training
    - iv. Note any malfunction of on/off switch, door interlocks or other safety equipment malfunction. Stop using instrument when a malfunction is discovered and immediately notify Supervisor and Instrument Support. Place note on machine that it is "Out of Service".
  - d. Instrument Support Unit (ISU)
    - i. Provide repairs to malfunctioning equipment
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- ii. Conduct radiation surveys every three years and after repairs or relocation
- iii. Record results of such surveys and provide copies to Lab Supervisor and Bureau Health and Safety Unit.
- iv. Provide for calibration of radiation survey instrumentation every three years and provide copy to BFS Health and Safety Program.
- e. BFS Health and Safety (HSU)
  - i. The Senior Industrial Hygienist will be designated the Radiation Safety Officer for the purposes of this RPP for the Bureau of Forensic Services.
  - ii. Develop, and maintain written BFS RPP.
  - iii. Develop safety training for RPP
  - iv. Review program annually for effectiveness and make modifications as appropriate.
  - v. Record personal exposure readings from each survey on “Personal Radiation Exposure Record” form (Attachment #2) and maintain. Provide to employee upon request.
  - vi. Maintain records of surveys, personal radiation exposures, registrations and correspondence for the BFS RPP. Maintain records of surveys and calibrations for three years.
  - vii. Review radiation regulations on routine basis.
  - viii. Notify DHS/RHB of machine transfer, relocation, sale or destruction.
  - ix. Notify DHS/RHB of equipment repair and provide survey results.


### **Application**

The RPP applies to the following BFS instrumentation, which produce x-rays through a tube:

- Faxitron
- EDAX Eagle II

Scanning Electron Microscopes (SEM) generate x-rays incidental to the operation of the machine and at a low rate. X-rays can only be generated within the vacuum chamber during operation. SEM meet the requirements of 17 CCR 30125 as an “excluded machine”, and do not have to be registered, or meet the requirements of the RPP. SEM will be surveyed every three years to assure leakage rates are within manufacturer’s specifications and to document the “excluded machine” status.

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### **Occupational Dose and Exposure Control**

Since it is not known what level of radiation causes cancer, the Policy of the Bureau of Forensic Services is to keep employee exposures as low as reasonably achievable (ALARA). This is accomplished through engineering of the instrument and leak surveys. Employees are also instructed in proper operational procedures.

Section 20.1201 of 10 CFR allows a worker to be exposed to an annual total of 5 rems (equivalent to 5 R) to the whole body; 15 rems (15 R) to the eye, and 50 rems (50 R) to the skin or extremity.

### **Engineering Control**

Through the use of shielding and interlocks (devices that prevent operation with the door open), radiation exposure is kept low. Literature from the manufacturers of our instruments indicate the following leakage rates during operation:

Faxitron	0.5 mR/hr @ 2 inches
Eagle II	0.25 mR/hr @ 2 inches


### **Personal dosimetry**

Personal dosimetry is required at exposures of 500 mR/yr. Given the factory leakage rate of 0.5 mR/hr, an employee would have to operate the instrument 1000 hours and be within 5 cm of the source to reach this dose level. Since this is extremely unlikely, and given the actual leakage data listed above is at most 10% of the specified leakage rate, personal dosimetry will NOT be required.

To confirm the engineering controls are functioning properly, a survey of each machine will be conducted every three years, when re-located or after a repair. Records of the survey will be kept at each laboratory for reference.

Since a malfunction may cause a greater leakage that permitted under normal operation, personal dosimetry will be kept for personnel conducting annual and repair related radiation surveys. The procedure for using personal dosimetry is described in Attachment #3. The information is recorded on the Survey form, and will be transferred to the Personal Radiation Exposure form found in Attachment #2 by HSU. HSU will keep records of employee exposure. Employees may request a copy of their exposure forms at any time.

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### **Leakage Surveys**

To verify that the instrument engineering controls are operating properly, a leak survey of the instrument will be conducted

- Every three years to insure proper operation of engineering controls; or
- Whenever the instrument is disassembled, repaired, or relocated.

Procedures described in Attachment #3 will be used to complete all radiation surveys.

Any indication that leakage above the factory specifications will require the instrument to be immediately powered-down, tagged as malfunctioning and prohibited from use until properly repaired.

Leak survey results will be sent to HSU for review. Leak surveys will be kept for three years.

Leak survey instrumentation will be calibrated on a periodic basis, not to exceed three years. Records of calibration will be kept for 3 years.

### **Declared Pregnancy and Dose to Embryo/Fetus**


Occupational exposure to a declared pregnant woman must not exceed 500 mrem. A declared pregnancy is one that is provided in writing to the supervisor, including the estimated date of conception. A declared pregnant woman will be provided dosimetry whenever operating the instrument.

If a pregnant woman wishes to request removal from duties involving ionizing radiation exposure, DLE Order #02-03, "Reproductive Health" describes procedures to request that.

### **Public Dose**

The allowable public dose is 100 mrem. In the event special tours are arranged, the instruments will not be operated until all non-BFS personnel leave the area.

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General Operation Procedures (posting format found in Attachment #4)

A copy of these procedures will be posted on each instrument:

- a. Only workers that have been trained on the equipment may use the instruments.
- b. If any indicator or interlock switch does not seem to work correctly (as the operator remembers it working), the operator shall at least turn the power off to the X-ray source and refer to the instruction manual to determine if the instrument safety features are working as indicated by the manufacturer.
- c. If the instrument is not working as indicated by the manufacturer, the instrument shall be turned off (completely powered down) and tagged (marked/posted) as malfunctioning. See “5. Emergency Procedures” below.
- d. Only personnel from ISU may disassemble or take-a-part any X-ray source laboratory equipment.
- e. After any disassembly, repair, or relocation of X-ray sources equipment, the ISU shall ensure the instrument is operating in accordance with the manufacturer’s design and specification parameters including survey monitoring to ensure that the maximum leakage is not exceeded.
- f. A copy of these safety requirements and controlling regulations (CFR Title 17 and CFR Title 10) are to be kept in the vicinity of the machine. A copy of form RH-2364, “Notice to Employees” (Attachment #1) shall be conspicuously posted by each piece of laboratory equipment that has an x-ray tube source. (i.e., all sources except the SEM’s).
- g. Operating instructions and manuals must be immediately available.
- h. Notify HSU immediately in the event of any abnormal personnel radiation exposure.
- i. DHS/RHB must be notified of disposal or relocation of x-ray cabinetry. Notify HSU prior to the acquisition, disposal, or transfer of any x-ray cabinet.

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### Emergency Procedures

In the event the operator has reason to believe that the instrument is not working as indicated by the manufacturer, the instrument will be immediately shut down. The lab supervisor will be immediately notified. The instrument will be tagged (marked/posted) as malfunctioning. ISU and HSU will be notified as soon as feasible. Before repairs are completed, the instrument will be surveyed for leakage by HSU to estimate the possible dose to the original operator. DHS/RHB will be notified by the Supervisor in accordance with 17 CCR 30295(2)(B) by telephone within 24 hours, and a written report will be submitted within 30 days to DHS/RHB.

### Disposal of Unwanted Equipment

Care must be taken in disposing of the unit. The X-ray Cabinets may have hazardous wastes such as a beryllium-copper target, PCBs in the transformer oil and considerable amounts of lead in the shielding and generator. Contact HSU when seeking to dispose of the unit in question. They will assist with proper notifications to DHS/RHB and assist in proper disposal of the unit.


### Training

The BFS Health and Safety Training Program Section 10 contains the specific training requirements for employees, supervisors and instrument technicians with regard to radiation safety.

No one shall be permitted to operate a radiation producing instrument until such individual has receive a copy of and instruction in, and demonstrated an understanding of, operating procedures for the unit and has demonstrated competence in it's use. This will be documented and kept with the employee's training records.

Before initial use, each new user will review this policy and procedure, complete the radiation safety training and pass a test on the subject matter with at least an 80% score. A copy of the test will be kept for three years.

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### Inventory

<u>Laboratory</u>	<u>Instrument</u>
Redding	Faxitron
Santa Rosa	Faxitron, Eagle II
Watsonville	Faxitron, Eagle II
Fresno	Eagle II
Chico	Eagle II
CCI	Faxitron, Zeiss SEM
Ripon	Faxitron, FEI Quanta 400 SEM
Riverside	FEI Quanta 400 SEM

### Records

The laboratory shall keep records of competency and safety training for three years. Each lab will also keep a copy of the registration for the instruments at that facility.

Copies of registrations provided by DHS/RHB, surveys, personal radiation exposure forms and correspondence will be maintained by HSU. Records of Surveys and Instrument Calibration will be kept for a minimum of three years.

### Registration

All instruments (excluding scanning electron microscopes) producing ionizing radiation will be registered with DHS/RHB.

If a new instrument is being procured or an instrument is moved to another facility or dismantled, then HSU must be notified and will submit revisions of the registration to DHS/RHB.

### Annual Review

HSU will conduct an annual review of the RPP. This will consist of a review of survey data, personal dosimetry, repair records, general operating procedures and postings. A written document summarizing the annual review will be completed by March 1 of the year following the calendar year reviewed. A copy of the annual review will be provided to each laboratory and a copy kept at HSU.

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**Radiation Protection Program**

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ATTACHMENT #1  
RADIATION SAFETY POSTER, RH-2364  
**NOTICE TO EMPLOYEES**

**STANDARDS FOR PROTECTION AGAINST RADIATION**

CALIFORNIA RADIATION CONTROL REGULATIONS (CALIFORNIA CODE OF REGULATIONS, TITLE 17, SECTION 30255)

The California Radiation Control Regulations include standards for protection against radiation hazards. The State Department of Health Services has primary responsibility for administering these standards which apply to both employers and employees. Enforcement is carried out by the Department of Health Services or its authorized inspection agencies.

**EMPLOYEES' RESPONSIBILITIES**

You should know and understand those California radiation protection standards and your employer's operating and emergency procedures which apply to your work. You should comply with these requirements for your own safety and the safety of others. Report promptly to your employer any condition which may lead to or cause a violation of these standards or employer's operating and emergency procedures.

**SCOPE OF THE STANDARDS**

The Standards for Protection Against Radiation define:

1. Limits on exposure to radiation and radioactive materials;
2. Actions to be taken after accidental exposure;
3. Working conditions requiring personnel monitoring, safety surveys, engineered controls, and safety equipment;
4. Proper use of caution signs, labels, and safety interlock devices;
5. Requirements for keeping worker exposure records and reporting of such exposures;
6. The requirement for specific operating and emergency procedures for radiation work; and
7. The rights of workers regarding safety inspections.

**EMPLOYERS' RESPONSIBILITIES**

Your employer is required to:

1. Comply with the requirements of the California Radiation Control Regulations, Departmental orders and license conditions;
2. Post or make available to you copies of the Radiation Control Regulations, any license issued thereunder, and your operating and emergency procedures;
3. Post any notice of violation of radiological working conditions; and

4. Provide you with information on your exposure to radiation.

**REPORTS ON YOUR RADIATION EXPOSURE HISTORY**

1. California Radiation Control Regulations require your employer to give you a written report if you receive an exposure greater than the limits set in the radiation safety standards. Basic limits for occupational radiation exposure can be found in Section 30253 referencing title 10, Code of Federal Regulations, part 20. Limits on exposure to radiation and exposure to concentrations of radioactive material in air are specified in title 10, Code of Federal Regulations, part 20, subpart C.
2. If the radiation protection standard, under 10 CFR 20 (subpart F) requires that your radiation exposure be monitored, your employer must, upon your request, (a) give you a written report of your exposures upon termination of your employment, and (b) advise you of your exposures annually.

**INSPECTIONS**

The Department or one of its contractors will inspect your workplace from time to time to ensure that health and safety requirements are being followed and that these requirements are effective in protecting you. Inspectors may confer privately with you at the time of inspection. At that time you may direct the inspector's attention to any condition you believe is or was a violation of the safety requirements.

In addition, if you believe at any time that any health and safety requirements are being violated, you or your workers' representative may request that an inspection be made by sending a complaint to the Department of Health Services or other official agency. Your complaint must describe the specific circumstances of the apparent violation and must be signed by you or your workers' representative. The Department is required to give your employer a copy of any such complaint. Names may be withheld at your request. You should understand, however, that the law protects you from being discharged or discriminated against in any way for filing a complaint or otherwise exercising your rights under the California Radiation Control Regulations.


**POSTING REQUIREMENTS**

Copies of this notice must be posted in a sufficient number of places in every establishment where employees are employed in activities regulated by the California Radiation Control Regulations, to permit employees working in or frequenting any portion of a restricted area to observe a copy on the way to or from their place of employment.

**FOR RADIOLOGICAL EMERGENCY ASSISTANCE (24/7), PHONE 1-800-852-7550**  
To contact the Radiologic Health Branch, phone 916-327-5106 or go to [www.dhs.ca.gov/rhb](http://www.dhs.ca.gov/rhb)

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Attachment #3  
Instrument Support Unit  
Radiation Survey Procedure

Following any repair of an x-ray containing unit (Eagle II, Faxitron, Zeiss SEM or Link Analytical), the device will be surveyed while operating with the **Ludlum Model 3 Survey Meter**. To properly survey the device for leakage, the following steps must be performed:

1. Using the model AT750 charger, zero the three model AT138s personal dosimeters. Place one dosimeter at least 10 feet away from the device to be tested. Place the other two dosimeters in your shirt pocket. Record the levels (0 millirems) and the time on the survey sheet.
2. Turn on the Ludlum Model 3 Meter and set at the lowest range (X0.1). Observe the instrument for one minute. Estimate background radiation rate. Estimate the value and multiply by 0.1. Record value on survey sheet.
3. Turn on device to be tested. Hold the instrument probe 2 at the distance specified for the particular device being at the door for one minute. If the needle appears to “peg”, move the multiplier knob up to the next setting. Record the value on the survey form. Repeat at the sides of the device. Record value.
4. Subtract background level from measured level and record. If levels exceed maximum permissible levels indicated on the survey sheet, then leakage is occurring and must be corrected. If the level is below the maximum permissible levels, then the instrument is operating satisfactorily.
5. After the survey is complete, remove the dosimeters and record readings and time. Collect the third dosimeter used for background and record the time.
6. Provide a copy of the survey sheet to the laboratory director for inclusion in the Lab Safety Inspection Report. Submit a copy to the BFS Senior Industrial Hygienist. Keep the original in the Instrument Support Unit.

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**INSTRUMENT SUPPORT UNIT  
RADIATION SURVEY FORM**

**Electronic Specialist:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
**LAB Location:** \_\_\_\_\_ **Instrument:** \_\_\_\_\_  
 Serial # \_\_\_\_\_ State Decal # \_\_\_\_\_

**Dosimeter Information**

S/N # 46343 Initial reading (mrem) \_\_\_\_\_ Time: \_\_\_\_\_

Final reading (mrem) \_\_\_\_\_ Time: \_\_\_\_\_

S/N # 46344 Initial reading (mrem) \_\_\_\_\_ Time: \_\_\_\_\_

Final reading (mrem) \_\_\_\_\_ Time: \_\_\_\_\_

S/N # 46365 Initial reading (mrem) \_\_\_\_\_ Time: \_\_\_\_\_

Final reading (mrem) \_\_\_\_\_ Time: \_\_\_\_\_

**Checked with Ludlum Model 3 Survey Meter (S/N 178779 )  
Probe Model 44-3 (S/N PR 183400)**

Background reading (1 minute average): \_\_\_\_\_  $\mu$ R  
 Radiation reading, tube (1 minute average): \_\_\_\_\_  $\mu$ R @ \_\_\_\_\_ K Volts/Distance from source \_\_\_\_\_  
 Radiation reading, door (1 minute average): \_\_\_\_\_  $\mu$ R @ \_\_\_\_\_ K Volts/Distance from source \_\_\_\_\_  
 Radiation Front side @ 0° (1 minute average): \_\_\_\_\_  $\mu$ R @ \_\_\_\_\_ K Volts/Distance from source \_\_\_\_\_  
 Radiation Front side @ 90° (1 minute average): \_\_\_\_\_  $\mu$ R @ \_\_\_\_\_ K Volts/Distance from source \_\_\_\_\_  
 Radiation Front side @ 180° (1 minute average): \_\_\_\_\_  $\mu$ R @ \_\_\_\_\_ K Volts/Distance from source \_\_\_\_\_

1. Tube reading, actual survey \_\_\_\_\_ minus background \_\_\_\_\_ = \_\_\_\_\_  $\mu$ R  
 Within maximum leakage: Y \_\_\_ N \_\_\_
2. Door reading, actual survey \_\_\_\_\_ minus background \_\_\_\_\_ = \_\_\_\_\_  $\mu$ R  
 Within maximum leakage: Y \_\_\_ N \_\_\_

**Manufacturer**


Faxitron  
Eagle II

**Instrument Maximum Leakage Specifications**

**Reading Level**

500  $\mu$ R/hr at 2 inches  
250  $\mu$ R/hr at 2 inches


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Attachment #4  
General Operating Procedures

- a. Only workers that have been trained on the equipment may use the instruments.
- b. If any indicator or interlock switch does not seem to work correctly (as the operator remembers it working), the operator shall at least turn the power off to the X-ray source and refer to the instruction manual to determine if the instrument safety features are working as indicated by the manufacturer.
- c. If the instrument is not working as indicated by the manufacturer, the instrument shall be turned off (completely powered down) and tagged (marked/posted) as malfunctioning. **Notify your supervisor immediately! Your Supervisor must notify the Dept. of Health Services Radiological Health Branch (RHB) 24 hours by phone.** A written report of the problem must be submitted to RHB within 30 days]. Notify the Instrument Support Unit (ISU) and the BFS Health and Safety Unit (HSU) as soon as possible.
- d. Only personnel from ISU may disassemble or take-a-part any X-ray source laboratory equipment.
- e. After any disassembly, repair, or relocation of X-ray sources equipment, the ISU shall ensure the instrument is operating in accordance with the manufacturer's design and specification parameters including survey monitoring to ensure that the maximum leakage is not exceeded.
- f. A copy of these safety requirements and controlling regulations (CFR Title 17 and CFR Title 10) are to be kept in the vicinity of the machine. A copy of form RH-2364, "Notice to Employees" (Attachment #1) shall be conspicuously posted by each piece of laboratory equipment that has an x-ray tube source. (i.e., all sources except the SEM's).
- g. Operating instructions and manuals must be immediately available.
- h. Notify HSU immediately in the event of any abnormal personnel radiation exposure.
- i. DHS/RHB must be notified of re-location or disposition of x-ray cabinetry. Notify HSU prior to the acquisition, disposal, or transfer of any x-ray cabinet.

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Attachment #5: Regulatory Requirements Summary

**California Code of Regulations, Title 17**

**Section 30108:**

Registration requirement for device that produces radiation

**Section 30115:**

Report of Change. The Registrant shall report in writing to the Department, within 30 days, any change in registrant's name, address, location or receipt, sale, transfer, disposal or discontinuance of use of any reportable source of radiation.

**Section 30145: Registration Fee**

- (a)(2) Medium priority radiation machine
- (e) \$115 annual fee/machine not to exceed \$4000.

**Section 30253:** Standards for Protection Against Radiation, 10 CFR sections 20.110-20.2402 apply.

**Section 30254:** Inspection (RHB/DHS can inspect us)

**Section 30255:** Notices, Instructions and Reports to Personnel

1. inform users of radiation of health problems from radiation exposure, procedures to minimize exposure, purposes of protective devices employed; instruct users of reporting requirements, response to warnings made by malfunction and of radiation exposure reports they may request
2. post a copy of the regulation, copy of operating and emergency procedures
3. post a copy of Form RH-2364
4. post any notice of violation within 2 working days of receipt
5. provide reports exposure reports to any individual requesting them

**Section 30293(a):** Records: each user shall keep records showing the receipt, transfer and disposal of each source of radiation for 3 years

**Section 30295:** Notification of Incidents

Notify RHB within 24 hrs of equipment failure by phone. Send follow-up report within 30 days

**Section 30336(a):** Cabinet Radiography


- (1) No user shall permit any individual to operate a cabinet radiography unit until such individual has receive a copy of and instruction in, and demonstrated an understanding of, operating procedures for the unit and has demonstrated competence in it's use.

**Title 10 of the Code of Federal Regulations**

**Section 20.1101**

- (a): implementation of a radiation protection program commensurate with the scope and extent of licensed activities.

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(b) use procedures to keep exposures that are as low as reasonably achievable (ALARA).

(c) periodically review (at least annually) the radiation protection program content and implementation.

**Section 20.1501**

(b) instruments used for quantitative radiation measurements are calibrated periodically

**Section 20.2103.** Records of surveys

(a) records showing results of surveys and calibrations kept for 3 years.

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