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Abstract
This document describes the operation of the Rocketdyne External Dosimetry Program. It explains the selection criteria for dosimetry devices, describes recordkeeping practices associate with the program, and discusses investigation requirements for anomalous dosimetry results.

This document supersedes N001TI000375 of the same title.

Supporting Document Summary of Change

Rev.	Summary of Change	Approvals and Date
A	Updates Technical Basis Document to reflect the use of Optically Stimulated Luminescent Dosimeters (OSLD), and reflects simplification of badge issue strategies. Clarifies record retention policies.	P. D. Rutherford / D. Koncel / **SEE METAPHASE FOR SIGN-OFF** **RELEASE 12-17-03 CV**

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1.0 Introduction

1.1 This document describes the use of personnel dosimetry to monitor exposure to ionizing radiation.

1.2 Personnel dosimetry consists of the issue, tracking, return, and evaluation of a device used to determine the occupational radiation dose an individual has received while employed at Rocketdyne's San Fernando facilities.

1.3 This procedure applies to any Rocketdyne activity requiring the provision of dosimetry devices under one or more of the following regulatory documents:

1.3.1 State of California, Title 17, Division 1, Chapter 5, Subchapter 4, "Radiation."

1.3.2 U.S. Nuclear Regulatory Commission, 10 CFR 20, *Standards for Protection Against Radiation*.

1.3.3 State of California Broad Scope A Radioactive Materials License 0015-19.

1.3.4 U.S. Department of Energy 10 CFR 835, *Occupational Radiation Safety*.

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2.0 Characterization of Radiation Fields

2.1 Prior to the issue of dosimetry, a radiation field must qualitatively evaluated to ensure that the dosimetry device intended for use will effectively measure the radiation to which it is to be exposed.

2.2 National Voluntary Laboratory Accreditation Program (NVLAP)

2.2.1 At a minimum, dosimetry devices used at Rocketdyne must satisfy the requirements of the National Voluntary Laboratory Accreditation Program (NVLAP).

2.2.1.1 NVLAP identifies nine qualitative categories of radiation fields. These are described in NIST Handbook 150-4, *Ionizing Radiation Dosimetry,* 1994.

2.2.1.2 Rocketdyne requires that a laboratory be NVLAP accredited in the following categories:

NVLAP Test Category	Description
I	Accidents, Low Energy Photons
II	Accidents, High Energy Photons
IIIA	Low Energy Photons; General
IV	High Energy Photons
VC	Beta Particles; General
VI	Photon Mixture
VII	Beta-Photon Mixtures

2.2.1.3 This table is used to qualify the performance of various types of dosimetry. It should be noted that situations may occur where radiation outside the scope of NVLAP categories may be encountered. These situations may require the use of special types of dosimetry coupled with special interpretation of results.

2.2.1.4 Rocketdyne currently contracts with a third party vendor for dosimetry services. This vendor is required by contract to maintain NVLAP accreditation. Accordingly, this procedure does not address processing performed by the vendor.

2.2.2 Department of Energy Laboratory Accreditation Program (DOELAP)

2.2.2.1 Rocketdyne, as the operator of the former Department of Energy's Energy Technology Engineering Center (ETEC), is mandated by the Department of Energy to provide DOELAP accredited dosimetry to ETEC remediation personnel.

2.2.2.2 DOELAP uses a more rigorous irradiation scheme than called for by NVLAP. No commercial vendor currently meets the full scope of the DOE's required test suite.

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2.2.2.3 Rocketdyne depends exclusively upon commercial vendors for the provision of dosimetry. Accordingly, it has requested and been granted exemption from DOELAP participation. Rocketdyne will provide NVLAP accredited dosimetry to ETEC remediation personnel.

2.2.3 Special Calibration

2.2.3.1 NVLAP accredited dosimetry is generally linear in its response across the NVLAP energy spectrum.

2.2.3.2 If a dosimeter is to be used in a field where the energy of the components are much different than the NVLAP criteria (e.g., photons greater than 2 Mev), a special calibration should be performed to standardize the response of the device, or the results of the device should be verified and corrected for any response non-linearity.

2.3 Methods of Characterization

2.3.1 In order to determine the correct dosimetry for a given situation, the type of emission, the energy spectrum, and the expected dose rate of the field must be determined. This is called "characterization."

2.3.2 The following activities may be used to characterize a radiation field.

2.3.2.1 Process Evaluation

2.3.2.1.1 Radiation can be characterized by analyzing the production process and determining the energy of radiation by engineering calculation, interpolation, or extrapolation.

2.3.2.1.2 This method generally results in a conservative estimate of the energy of the radiation spectrum.

2.3.2.1.3 Evaluations performed should be documented and retained. Assumptions and limitations should be clearly specified.

2.3.2.2 Laboratory Gamma Spectroscopy

2.3.2.2.1 Sensitive to photons only, gamma spectroscopy utilizes cryogenic detection probes that are very sensitive to gamma energies.

2.3.2.2.2 A sample a radioactive material is analyzed for its energy spectrum. Once the precise spectrum is known, an analysis of isotopic content can be performed.

2.3.2.2.3 When the isotopic content is known, a more precise process evaluation can be performed.

2.3.2.3 Field Gamma Spectroscopy

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2.3.2.3.1 Field spectroscopy is similar to laboratory spectroscopy except that the spectroscopic probe is placed directly in the radiation field.

2.3.2.3.2 This method has the advantage of not requiring a sampling action. Because of the sensitivity of the probe, one cannot perform such an analysis in radiation fields greater than 1.0 mr/hr.

2.3.2.3.3 When the energy spectrum of the radiation is known, more precise process evaluations can be performed.

2.3.2.4 Area TLD/Film Badge posting

2.3.2.4.1 Film badges or TLDs are used to determine the dose rates in a given location. Film Badges or TLDs can be posted in a radiation field, left for a period of time, and then removed and processed.

2.3.2.4.2 Depending on the badge design, the incident fields can be characterized into categories (generally "low", "medium", or "high" energies).

2.3.2.5 Field Surveys

2.3.2.5.1 Field survey instruments are used to determine the dose rate of a given radiation field. Certain field survey instruments can be used to determine the makeup of a radiation field.

2.3.2.5.2 Gamma and Beta components of a field can usually be readily determined using an Ion Chamber (e.g., Eberline R02, Bicron RSO-5).

2.3.2.5.3 Low energy X-ray components can be determined using an ion chamber.

2.4 General Characterization of Rocketdyne Radiation Fields

2.4.1 X-ray Generators

2.4.1.1 Radiography, Shielded Room

2.4.1.1.1 Rocketdyne operates a number of shielded X-ray rooms.

2.4.1.1.2 Each cell contains one or more X-ray tube heads, and may be serviced by more than one console. X-rays are produced using a heated cathode, continuous or half-wave tube design.

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2.4.1.1.3 Kilovolt-peak (Kvp) potentials range up to 420 Kvp. Because of the statistical nature of Bremsstrahlung interactions, the average X-ray energies are generally 40 - 60% of the maximum rated power of the tube; a tube operated at 320 Kvp will produce an average X-ray energy of 130 - 190 Kilo-electron volts (Kev). A tube operated at 160 Kvp will generate an X-ray energy ranging between 60 Kev to 100 Kev.

2.4.1.1.4 Because of the variation in ranges produced by the equipment, dosimetry devices must meet NVLAP Class VI (Mixed Photon). Where possible, the interpretation of results should be optimized for 50 Kev to 200 Kev X-rays[1].

2.4.1.1.5 At Rocketdyne, personnel who work with X-rays generally do not work with radioactive materials. Mixed photon / beta fields are generally not encountered and additional badging for this category is not needed.

2.4.1.2 Radiography, Field

2.4.1.2.1 On an as-needed basis, Rocketdyne operates field X-radiography.

2.4.1.2.2 The maximum Kvp of these field units is 160 Kvp. Average X-ray energy is between 64 - 100 Kev.

2.4.1.2.3 The dosimetry specified for shielded room X-radiography is adequate for operators of field radiography equipment.

2.4.1.3 Accelerators

2.4.1.3.1 Rocketdyne currently operates a 7 Mev Computer Assisted Tomography (CAT) Scanner. This device utilizes an electron linear accelerator to create pulsed X-ray beams. Other accelerator devices are periodically operated at Rocketdyne facilities.

2.4.1.3.2 Direct characterization of the X-ray beam is not possible due to the short pulse times and due to the extremely high fluxes created by the system.

2.4.1.3.3 An accelerator spectrum is more energetic than commonly encountered in typical Rocketdyne X-ray operations. NVLAP accreditation may not be adequate if a dosimeter is to be exposed to unattenuated X-rays at an average energy of 2 Mev or above, a situation not normally encountered in routine operations.

2.4.1.3.4 If the average energy of the X-ray is greater than 2 Mev, then either the dosimeter should be calibrated to the high energy X-ray field, or results of the dosimeter's processing should be evaluated and corrected for any non-linear response of the dosimeter.

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[1] Most vendors can provide a specialized algorithm for this optimization.

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2.4.1.3.5 *Scattered* radiation from the system is attenuated, and the energy levels that penetrate the shielding walls are reduced in energy to a level that they are within the response envelope of the dosimeter.

2.4.1.4 Analytical Analysis

2.4.1.4.1 Rocketdyne operates several cabinet type X-ray diffraction and X-ray fluorescence systems.

2.4.1.4.2 The X-ray energies of this equipment range between 20 - 100 Kvp.

2.4.1.4.3 Badges used for X-ray radiography are appropriate for this application.

2.4.2 Radioactive Materials

2.4.2.1 Rocketdyne is currently permitted to possess a number of different radioactive isotopes in different forms. Because of the complexity of its inventory, specific isotope by isotope dosimetry requirements is beyond the scope of this document.

2.4.2.2 Regulations require that three categories of dose be tracked by personal dosimetry:

2.4.2.2.1 Skin dose is assessed at a tissue equivalent depth of 0.007 cm2/g (0.007 cm of skin).

2.4.2.2.2 Eye dose is assessed at a tissue equivalent depth of 0.300 cm2/g (the lens of the eye is located approximately 0.3 cm under the surface of the eye).

2.4.2.2.3 Deep dose is assessed at a tissue equivalent depth of 1.0 cm2/g (1 cm of soft body tissue).

2.4.2.2.4 These doses are typically tracked by the use of filtration devices in the dosimeter.

2.4.2.3 Photons deposit energy in tissue through a statistical process. Because of this, it is difficult to determine at what depth a photon will deposit energy. Photon energies of 10 Kev or above can readily deliver doses to body tissues at any depth. Accordingly, gamma dosimetry should be used in significant fields above 10 Kev energy.

2.4.2.4 Beta particles deposit energy in tissue through another interaction pathway than photons. Accordingly, a beta's range in tissue is more directly energy dependent. A beta particle with an energy of greater than 70 Kev can deliver a dose to the skin. A beta particle with an energy of greater than 800 Kev can deliver a dose to the lens of the eye. A beta particle with an energy of greater than 1,100 Kev can deliver a dose to the deep tissues of the body.

2.4.2.4.1 An isotope with a maximum beta emission energy (E_{max}) less than these respective threshold energies would not require dose monitoring for a depth dose greater than the its beta particle's maximum range.

2.4.2.4.2 The average beta energy is generally 1/3 of the E_{max}. If the average energy of the isotope's

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beta particle is less than the threshold dose energy, consideration can be given to not requiring monitoring, provided that the activity of the source is small enough that the dose from the more energetic components of the beta energy spectrum would be insignificant.

2.4.2.5 Neutron interactions with body tissues are a statistical interaction process. As with photons, the depth of dose is difficult to predict. Neutron dosimetry should be used in significant fields of any energy.

2.4.2.5.1 Where possible the spectrum of energies contained in the neutron radiation field should be established.

2.4.2.5.2 Neutron dosimetry responsive to the spectral components of the field should be procured and used to monitor personnel (more than one monitoring device may need to be used to ensure full spectral monitoring).

2.4.2.6 Ni-63 (as flame spectrometer check sources) are currently found in the Rocketdyne radioactive materials inventory.

2.4.2.6.1 The isotope emits a weak (< 70 Kev) beta, and does not present an external radiation hazard.

2.4.2.6.2 External dosimetry is not required for monitoring exposures from these weak beta emitters.

2.4.3 Electronic/Industrial Equipment

2.4.3.1 Electron Microscopes

2.4.3.1.1 Electron microscopes create X-rays as a byproduct of the collision of accelerated electrons with the phosphors in the imaging surfaces.

2.4.3.1.2 Electron microscope X-ray energies are low. These energies are readily attenuated by the cabinet walls containing the parts.

2.4.3.1.3 Generally, personnel do not require the use of dosimetry. If personnel are badged, X-ray badging should be used.

2.4.3.2 E-beam Welders

2.4.3.2.1 Electron beam welders create X-rays as a byproduct of the collision of accelerated electrons with the metals to be welded.

2.4.3.2.2 E-beam welder X-ray energies are low. The energies are readily attenuated by the vacuum chamber walls surrounding the work volume.

2.4.3.2.3 Generally, personnel do not require the use of dosimetry. If personnel are badged, X-ray badging should be used.

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3.0 Dosimetry Selection Criteria and Tracking Administration

3.1 Rocketdyne utilizes third-party vendors to provide and process dosimetry. A specimen specification for these devices and services is provided in Exhibit A.

3.2 The current vendor is Landauer, Inc. The following Landauer badge types are acceptable for monitoring the specified dose categories.

Type Code	Description	Radiation Type
P	OSLD ("Luxel")	Shallow, Eye, Deep
K	TLD (LiF)	Shallow, Eye, Deep
G	Film	Eye, Deep (Shallow limited to High Energy beta))
U	Finger Ring	Shallow
X	Aluminum Oxide Environmental Badge	Photons
N	Neutron Badges, various energies and types ("Neutrak")	Thermal, Fast neutron (Eye, Deep)

3.3 The Account Numbers specify the readout algorithms to be utilized by Landauer. These algorithms are:

3.3.1 006001: Photon (X-ray); low, medium, high spectral readouts. Beta exposure is not anticipated.

3.3.2 010712: Mixed photon (gamma) and beta. Optimized readout for beta exposure.

3.3.3 151049 Mixed photon (gamma) and beta. Optimized readout for beta exposure.

3.3.4 297041 Aluminum Oxide Environmental Badges. Optimized readout for photons to 0.1 mrem.

3.3.5 006000: Mixed photon (gamma) and beta. Optimized readout for beta exposure. This account is reserved for use by Rocketdyne personnel working at offsite projects.

3.4 A Binary Number uniquely identifies the particular piece of film or TLD used in the badge holder.

3.5 Control Badges

3.5.1 Several control badges should be provided with each group in each Account (minimum of three controls per group).

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3.5.2 Control badges are to be maintained in a low ambient dose. These badges are required to correct personnel badge readings for background radiation exposure. These badges should NOT be stored in shielded containers.

3.5.3 When badges are shipped to Landauer for processing, a Shipment Control badge is to be provided in the package.

3.5.3.1 This badge is used to correct for any radiation received during transportation (such as from X-ray package inspection equipment).

3.5.3.2 Should such an irradiation occur, a dose correction request is to be processed through the State of California.

3.5.3.3 When permission is received from the State, Landauer is to be directed to correct the dose totals.

3.6 X-ray Operations

3.6.1 Badges are to be assigned from Account 006001.

3.6.2 Landauer Type "G" film badges, when used, shall be exchanged on a monthly basis.

3.6.3 Landauer Type "K" (TLD), “U” (Finger TLD), and “P” (OSLD) badges should be exchanged on a quarterly basis.

3.7 Radioactive Materials

3.7.1 For personnel working in non-DOE activities, badges are to be assigned from Account 010712.

For personnel working in DOE activities, badges are to be assigned from Account 151049.

3.7.2 Landauer Type "K" (TLD), “U” (Finger TLD), and “P” (OSLD) badges should be exchanged on a quarterly basis.

3.7.3 Landauer Type "G" film badges, when used, shall be exchanged on a monthly basis.

3.8 Special Dosimetry

3.8.1 Extremity Dosimetry

3.8.1.1 Extremity Dosimetry is currently not subject to NVLAP accreditation requirements.

3.8.1.2 Extremity Dosimetry returns results in Shallow Dose (only).

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3.8.1.3 When extremity badges are assigned, a "Chest Badge" ("CB") must be assigned with the extremity badges. The regularly worn whole body badge ("WB") is NOT worn with the extremity set; rather, the CB badge is worn in its place. This is necessary in order to properly calculate dose to the extremities over the calendar quarter.

3.8.1.4 Hand monitoring shall be conducted using Landauer Type "U" finger rings. By convention, finger rings are provided from Account 006001.

3.8.1.5 Other extremity monitoring (e.g., feet, ankles, wrists, forearms, etc.) shall be conducted using Type "P", "G", or "K" badges as described above. The badges should be assigned from the appropriate account.

3.8.2 Multiple Dosimetry

3.8.2.1 When individuals may be exposed to non-uniform exposure fields, the use of multiple dosimetry should be considered. Multiple dosimetry is the assignment of a number of dosimeters to be worn simultaneously. The dose from these dosimeters is then evaluated, and an equivalent dose assigned for the exposure period.

3.8.2.2 Type "G", "P", "K" TLD badges should be used for multiple assignments. The appropriate account should be selected based upon the radiation field characterization.

3.8.2.3 The regular whole body badge should **not** be worn with multiple dosimetry sets. A "CB" should be assigned and used as described above.

3.8.2.4 Evaluation and assignment of dose shall be conducted as directed by the RSO.

3.8.3 Neutron Dosimetry

3.8.3.1 Neutron sources are no longer present at Rocketdyne facilities.

3.8.3.2 If neutron dosimetry should become needed, contact Landauer with characterization data about the source of neutrons. Their recommendation should be followed in the selection of badge types.

3.8.4 Area Monitoring

3.8.4.1 In general, area monitoring is conducted using a "K" type TLD badge changed on a quarterly basis.

3.8.4.2 If extremely accurate monitoring is desired, a type "X" Al_2O_3 TLD should be specified. The user should be advised that these badges are significantly more expensive than the type "P" or "K" badge.

3.8.4.3 Area badges should be assigned to the account most appropriate to the type of facility being

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monitored.

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4.0 Distribution of Dosimetry

4.1 Generic Requirements

4.1.1 The criteria for the issue of personnel dosimetry is provided in the Rocketdyne Radiological Controls Manual ("RadCon Manual"), Section 511.

4.1.2 Badge Assignment

4.1.2.1 Personnel are issued dosimetry from a stock of unassigned badges maintained for the purpose.

4.1.2.2 Participant Numbers (PART_NO) are specific to the badge accounts.

Part Number Range	Account
99,000 – 99,999	006001
90,000 – 90,999	010712
91,000 – 91,999	151049
9,000 – 9,999	297041

4.1.2.3 An individual's wearing of a dosimetry badge conveys no access restrictions. Such restrictions are imposed as a function of his training status.

4.1.2.4 By special arrangements with Radiation Safety, badges can be distributed to a Principal User for distribution to visitors to that user's operation. In these cases, the Principal User is responsible for documentation of the issue and for training of the individual receiving the badge.

4.1.3 Routine Distribution of Dosimetry

4.1.3.1 An individual should be an employee of Rocketdyne, or a Rocketdyne contractor who anticipates a stay of longer than three months. Visitors or personnel in escorted status are not routinely re-issued dosimetry.

4.1.3.2 No individual should be routinely reissued dosimetry until that person has completed a basic radiation safety course permitting unescorted access to x-ray or radiological areas. Individuals whose training expires should be periodically culled from the list.

4.1.3.3 A re-issue roster is maintained as a convenience to Radiation Safety. No particular significance is attached to an individual's being listed except that Radiation Safety routinely issues the individual a film badge.

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4.1.3.4 A user may be removed from the permanent party list at the convenience of Radiation Safety. Expired training, failure to return badges in a timely manner, no demonstrated need for routine badges, etc., are all grounds for an individual's being deleted from the list.

4.1.2 Area Badging

4.1.2.1 Dosimetry is used to monitor the total dose received in a particular location. This is done to ensure that regulatory limits are being met, and to verify workplace survey data.

4.1.4.2 For tracking purposes, area badging is designated by a specialized location code beginning with "LLL". This designator is used for tracking similarly to the way an SSN is used for an individual.

LLL-BB-####		
LLL	BB	####
Location Designator	Building or Area Designator	Specific Location Designator

4.2 Description of Computerized Tracking System

4.2.1 All Rocketdyne dosimetry is tracked using a computerized tracking system. The system is based upon Dbase IV, v2.0 data structures and programs.

4.2.2 The RSO, or designee, shall maintain the necessary desk instructions for the issue, tracking, retrieval, and processing of dosimetry.

4.2.3 Flow charts and key diagrams for the system critical software used in the system should be provided where pertinent.

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5.0 Special Dose Calculations

5.1 Area Survey Data to personnel dose assignments

5.1.1 Where personnel dosimetry results are not available, or where the dosimetry results are not representative of actual dose received, then the results of area surveys may be used to assign dose.

5.1.2 Such evaluations shall be described in writing, with a copy of the evaluation and dose assignment placed in the individual's exposure records.

5.1.3 A calculated entry is denoted by the label "CALC" in the RECRD_TYPE (Record Type) field in the dosimetry computer system.

5.2 Hot Particle Dose/Skin Contamination Dose

5.2.1 Hot Particle Doses (or skin contamination doses) shall be evaluated using the VARSKIN Mod 2 computer code.

5.2.2 Parameters of the computations shall be recorded, along with the calculated dose assignment. These documents shall be filed in the individual's exposure record.

5.2.3 Comparison of the results to exposure limits shall be undertaken as described in the Radiological Controls Manual.

5.2.4 Results of the calculations are denoted by "CALC" entries in the RECRD_TYPE field in the computerized database.

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6.0 Dose Investigations

6.1 General

6.1.1 When a valid personnel dose cannot be determined from dosimetry, alternate methods of dose assignment (survey data, co-worker dosimetry results, time-motion studies, historical exposure information, etc.) shall be used to determine a dose for the badging period.

6.1.2 All reports and records generated in support of the assignment shall be filed in the individual's exposure file.

6.1.3 The Radiation Safety Officer shall review and concur in all assignments of dose that were determined by methods other than reads from primary personnel dosimetry.

6.2 Lost Badge

6.2.1 Individuals who lose dosimetry devices shall verbally inform Radiation Safety as soon as possible following the discovery of the loss.

6.2.2 Radiation Safety shall obtain a written report of the loss from the individual. The individual should file a report within 7 days of the loss of the device. Radiation Safety should provide the individual with a report form ASAP following the loss.

6.2.3 Radiation Safety may refuse to issue a replacement dosimeter (and deny access to radiological areas) pending the evaluation of dose for the badging period. This option is normally exercised if the individual has been potentially exposed to a significant amount of radiation, or if a credible suspicion of badge tampering exists.

6.2.4 Radiation Safety shall determine a reasonable dose assignment based upon the report data and a best estimate of the conditions the individual encountered.

If no report is filed in a timely manner, Radiation Safety may assign a dose based upon its best estimate.

6.3 Damaged Badge

6.3.1 Individuals who suspect that their dosimetry devices have been damaged (overheated, soaked in water or chemicals, smashed, etc.) shall verbally inform Radiation Safety as soon as possible following the discovery of the loss. It should be noted, however, that this damage is frequently not discovered until reported by the vendor.

6.3.2 Radiation Safety shall obtain a written report of the event leading to damage from the individual. The individual should file a report within 7 days of the loss of the device. Radiation Safety should provide the individual with a report form in a timely manner following the discovery of the damage.

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6.3.3 Radiation Safety may refuse to issue a replacement dosimeter (and deny access to radiological areas) pending the evaluation of dose for the badging period. This option is normally exercised if the individual has been potentially exposed to a significant amount of radiation, or if a credible suspicion of badge tampering exists.

6.3.4 Radiation Safety shall determine a reasonable dose assignment based upon the report data and a best estimate of the conditions the individual encountered.

If no report is filed in a timely manner, then Radiation Safety may assign a dose based upon its best estimate.

6.4 Badge Not Returned

6.4.1 Individuals shall return a dosimeter in a timely manner during scheduled badge exchange periods.

6.4.2 Individuals shall surrender a dosimeter when requested to do so by Radiation Safety.

6.4.3 Radiation Safety shall notify individuals who have not returned dosimetry in a timely manner. When notified, the individual shall make the necessary arrangements to return the dosimetry.

6.4.4 Dosimetry that is not returned within the calendar quarter following the close of the dosimeter's use period, shall be considered as lost. The lost dosimetry shall be evaluated as described in the lost dosimetry section.

6.4.5 Radiation Safety may deny new dosimetry to an individual who has failed to return previous dosimeters, and to an individual who has frequently failed to return dosimeters in a timely manner.

6.5 Unexpectedly High Dose

6.5.1 Under current regulatory practice, the exposure recorded on the primary dosimeter (TLD) is to be assumed to be correct. If an individual's exposure exceeds regulatory limits, then reports are to be filed with the cognizant regulatory agency (State of California or DOE) within the time frame stipulated in the pertinent regulations.

6.5.2 If it can be demonstrated that a read is anomalous due to a physical defect in the TLD or an error its processing, than the results of the dosimeter may be ignored and a dose assigned by evaluation.

6.5.2.1 In the event that a dose is significantly higher than anticipated, the vendor should be requested to re-evaluate the read in question, and, if warranted, a corrected value reported.

6.5.2.2 If the vendor reports the badge as being damaged or in some way physically affected by heat,

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light, moisture, etc., the read may be disregarded by Radiation Safety, and dose assigned by evaluation.

6.5.2.3 The vendor will provide a corrected record of the re-evaluated dosimeter read. Rocketdyne computer records should be annotated to indicate that the read was anomalous. This is generally done by setting the READ_STAT (read status) field to “W”.

6.5.3 If it can be demonstrated that a read is not representative of the dose actually received by the individual (such as an accidental exposure to a lost dosimeter), then, with the written concurrence of the cognizant regulatory agency, the questionable dose may be disregarded and a dose assigned by evaluation.

6.5.3.1 If no regulatory overexposure has occurred, then, to reduce unnecessary paperwork and overload of regulatory agency staff, questionable exposures of less than 100 mrem will not be processed.

6.5.3.2 A full report of the exposure scenario should be obtained from the affected individual and any witnesses.

6.5.3.3 Radiation Safety should determine a calculated dose that would be reasonably expected from the scenario described in the reports. The basis of this dose determination should be documented, along with any of the modifying or simplifying assumptions. Scenario recreations, test exposures, and other methods of direct determination of dose may be utilized in support of this calculation.

6.5.3.4 A written request for an adjustment of assigned dose should be made to the cognizant regulatory agency.

6.5.3.5 The regulatory agency will review the dose evaluation, and will deny permission to adjust dose, will grant permission to adjust the dose, or will grant permission to assign a modified dose value.

6.5.3.6 If an adjusted dose is authorized, then the computer and written records of the TLD read shall be annotated showing that an adjusted dose was assigned.

6.5.3.7 A copy of all documentation generated in the process shall be grouped and filed in the individual's exposure history file.

6.6 Pocket Dosimeter Off-Scale

6.6.1 If an individual's pocket dosimeter is found to be off scale during the conduct of radiological operations, the individual shall place all equipment into a safe status and immediately exit any radiation area.

6.6.2 The individual shall log the dosimeter reading in the pocket dosimeter log as "OFF SCALE."

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6.6.3 The individual is to prepare a written report detailing his or her activities. The report should contain adequate detail for Radiation Safety to estimate the dose received.

6.6.4 The individual shall contact Radiation Safety in a timely manner. In addition, the Principal User of the Use Authorization shall be contacted.

6.6.5 Radiation Safety shall deassign the individual's dosimeter and forward it to the vendor for processing. During this period, the individual is NOT TO BE ISSUED a replacement dosimeter without the express permission of the RSO. Additionally, the individual is not to engage in any radiological work pending results of the dosimeter evaluation.

6.6.6 When dosimeter results are returned, a new dose total for the badging period is to be determined. If Rocketdyne administrative dose limits permit, the individual may be issued a replacement dosimeter.

6.6.7 Any documentation generated in the evaluation of this event shall be filed in the individual's exposure history file.

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7.0 Dosimetry Records

7.1 Description of File Content

7.1.1 An exposure history file should be maintained for any individual who has been issued a TLD/film badge, or who has participated in the internal dosimetry program.

7.1.2 Exposure files should be periodically updated. Documentation of exposures should be prepared from the computer system and filed in the exposure history file on a nominally annual basis.

7.1.3 Exposure history file are critical records, and should be maintained in fireproof and floodproof locations.

7.1.4 Exposure history files are to be stored in accordance with Boeing record retention policies and procedures. See SM-40.407, *Radiological Records,* for additional guidance.

7.2 Personnel Folder Layout Scheme

7.2.1 Folders are generally created within a letter size manila file folder. Pages are mounted at the top using a standard two-hole punch and "ACCO" style retention clips.

7.2.2 Each file is sorted into sections. Each section is identified by a colored coversheet.

7.2.2.3 A suggested sorting scheme is described in RS-00027, *Compilation and Preparation of Exposure History Reports.*