

# GUTIERREZ - PALMENBERG INC.

## Radiation Dosimetry

GPI-26



Reviewed by:

*[Signature]* 2/17/97

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## Radiation Dosimetry

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1.0 Purpose and Scope

- 1.1 This procedure provides instructions for monitoring personnel for exposure to radiation in the workplace.
- 1.2 Radiation monitoring shall be conducted continuously when it is likely that any individual will exceed;
  - a. 10% of the annual limit of 5 rem, or 500 millirem.
- 1.3 Adherence to this procedure will provide assurance that exposures to radiation will be properly monitored enabling exposure to be controlled to As Low As Reasonably Achievable (ALARA).

2.0 Applicability

This procedure will be used for monitoring of all personnel for exposure to radiation. Monitoring will be provided as described in the site specific work plan for the job to be accomplished.

3.0 General

3.1 Definitions

- 3.1.1. *Monitoring* - Measurement of radiation exposure to evaluate potential dose equivalent to the individual.
- 3.1.2. *Dosimetry* - Devices worn on the body (TLD or PIC) to measure the radiation dose received by the exposed individual.
- 3.1.3. *Dose* - The deposition of energy in matter. Dose applies to energy deposited in any material by any type of ionizing radiation.
- 3.1.4. *Dose Equivalent* - The deposition of energy in living tissue. Equivalent to the radiation dose times the quality factor for the type of radiation.
- 3.1.5. *Quality Factor* - The factor which is radiation dependent and identifies the relative biological effectiveness of a radiation type and energy. The quality factor is multiplied times the Dose to yield the Dose Equivalent.

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- 3.1.6. *TEDE* - Total Effective Dose Equivalent - The sum of the Deep Dose Equivalent (external dose) and the Committed Effective Dose Equivalent (internal dose).
- 3.1.7. *CDE* - Committed Dose Equivalent - The dose equivalent to organs or tissues that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.
- 3.1.8. *CEDE* - Committed Effective Dose Equivalent - The sum of the products of all organs or tissues with CDE and their respective weighting factors.
- 3.1.9. *SDE* - Shallow Dose Equivalent - Also termed Skin Dose, it is used for external radiations which cause their primary energy deposition in the first 0.007 cm of tissue.
- 3.1.10. *EDE* - Eye Dose Equivalent - The dose delivered to a thickness of tissue of 300 mg/cm<sup>2</sup> by external radiations.
- 3.1.11. *DDE* - Deep Dose Equivalent - The dose equivalent delivered by external radiations to tissues deeper than 1 centimeter.
- 3.1.12. *TLD* - Thermoluminescent Dosimeter - A device which provides passive radiation measurement of DDE, SDE, or EDE.
- 3.1.13. *PIC* - Pocket Ion Chamber - A self indicating, integrating radiation exposure measuring device.

3.2 Site Registration Form

All new personnel and visitors required to enter a radiologically controlled area must complete a Site Registration Form (GPI Form 26-1) prior to starting work at a facility.

Completed Site Registration Forms will be retained with the individual's personnel exposure file. Site Registration Forms for GPI personnel will be updated annually or earlier if existing information is known to be incorrect.

3.3 Occupational Radiation Exposure History

An NRC Form 4 or equivalent must be completed by each individual and reviewed by the Project Manager or designee prior to the individual being permitted to work in a radiologically controlled area where a dose of more than 25 mRem could be received.

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3.4 Dosimetry Assignment

The TLD badge number, name, social security number, whether or not a worker has a completed NRC Form 4 or equivalent, the monitoring period (date from...to) and the individuals date of birth shall be recorded on GPI Form 26-1, for each individual monitored on a project. The original form will be maintained as a permanent record of the project monitoring. A copy will be maintained in the GPI Las Vegas office.

3.5 Occupational Exposure Limits & Administrative Control Levels

3.5.1 Nuclear Regulatory Commission limits per calendar year:

Whole Body (TEDE)	5 Rem
Eye Dose Equivalent (EDE)	15 Rem
Shallow Dose Equivalent (SDE)	50 Rem
Organ Dose (CDE)	50 Rem

3.6 Administrative Control Levels

3.6.1 GPI Radiation Administrative Control Levels per calendar quarter:

Whole Body (TEDE)	1.25 Rem
Eye Dose Equivalent (EDE)	3.75 Rem
Shallow Dose Equivalent (SDE)	12.5 Rem
Organ Dose (CDE)	12.5 Rem

3.6.2 The GPI Radiation Safety Officer (RSO) shall approve exposure above the Quarterly Administrative Control Levels.

3.7 RADIOLOGICAL CONTROLLED AREAS

3.7.1 A radiologically controlled area (RCA) is considered to be any portion of a facility, plant, vehicle or project for which restrictions apply for purposes of occupational radiation exposure control. Radiation exposures received within the boundary of a restricted area are occupational exposures. As described in the applicable Project Detail Work Procedure, radiologically controlled areas will be established to provide the specific radiological controls necessary for the completion of the work scope and the protection of all project personnel. The following guidelines apply:

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3.7.2 RCA Location

An RCA is always located within a restricted area as defined by 10CFR20. Each radiation area, high radiation area, airborne radioactivity area, and contaminated area shall be contained within a radiologically controlled area.

3.7.3 RCA Personnel Monitoring

All personnel and casual visitors within an RCA will be provided with appropriate dosimetry and monitored for radiation exposure.

4.0 Responsibilities

- 4.1 Program Director - The Program Director is responsible for insuring that all personnel assigned tasks using radioactive or hazardous materials are properly trained in their use and the necessity that they be monitored for exposure to radiations and hazardous materials as described in the site specific work plan.
- 4.2 Radiation Safety Officer - The Radiation Safety Officer (RSO) is responsible for training of personnel in the use of personal monitoring devices for radiation and for hazardous materials.
- 4.3 Project Manager - The Project Manager is responsible for ensuring that personnel at the work site understand the proper use of monitoring and recording exposure to radiations and hazardous materials.
- 4.4 Health Physics Technicians - Health Physics Technicians are responsible for performing the surveys described in the site specific work plan and ensuring the proper use of monitoring devices by workers.
- 4.5 Workers - All personnel are required to wear their dosimetry as required by the Radiation Work Permit and to maintain their exposure to radiation ALARA.

5.0 Procedure

5.1 Radiation Dosimetry - TLD

All personnel who could potentially receive 10% or more of the permissible legal limit for external radiation exposure are required by 10CFR20 to be furnished with personnel monitors. In the interests of ALARA, all personnel who work with radioactive material are required to wear appropriate radiation exposure monitors. Personnel working within an RCA will receive, at a

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minimum, a TLD and for work in areas with dose rates above 5 mrem/hour, a TLD and a low range Pocket Ion Chamber (PIC).

TLDs are the permanent record of an individual's occupational radiation exposure. Upon receipt of Project dosimetry, TLDs and TLD finger rings shall be stored in a low background area inside the project main office or in other designated storage locations when not in use. A (TLD) control badge shall be kept where the assigned badges are stored when they are not in use. All GPI personnel entering a Radiological Control Area (RCA) where 25 mRem could be received will be issued a TLD.

The individual's name, social security number, issue date, and date of return will be recorded on the Monthly Dosimetry Issue Log, (GPI Form 26-3).

5.1.1 At a minimum, personnel exposed to radiation in areas posted for protection of personnel, shall wear a thermoluminescent dosimeter (TLD) provided by a NVLAP certified vendor for the exposure period.

The TLD which monitors total body DDE shall be worn on the front torso in the region of the torso expected to receive the highest dose. In cases where other areas of the body may receive a higher dose, the HP technician shall evaluate and formally require (by specification on the RWP) that the total body dosimetry be worn at that body location.

5.1.2 Extremity monitoring shall be provided when necessary as described by the specific site work plan.

5.2 Pocket Ion Chamber

All personnel working in a radiologically controlled area may be issued/monitored by a Pocket Ion Chamber (PIC). PIC's may either be issued for an individual or group depending on the type and duration of work to be performed. The Project Manager or designee will determine if it will be necessary to issue individual or group PIC's. The PICs used for general radiation work will have a range of response of 0 to 200 millirem. PICs will be set to zero (0) at the start of each work shift.

5.3 Visitors/Group Monitoring

A casual visitor is any person touring or visiting the RCA on an infrequent basis, escorted while in the restricted area and not performing or supervising hands-on work.

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Visitors will be issued a TLD on a case by case basis depending on the type and duration of the job. The Project Manager or designee shall determine if a TLD is to be issued to a visitor. TLDs will always be issued to occupational workers expected to exceed 25 mrem. A visitor expected to receive in excess of 25 mrem shall be trained as, and considered an occupational worker.

5.3.1 Visitor RCA Conditions

A visitor may be escorted into an RCA provided that:

- there are not entries into high radiation areas, surface contamination areas, or airborne contamination areas,
- the external radiation exposure is limited to 50 mrem per year, or 10 mrem per entry.
- the visitor is furnished with a personnel radiation dosimeter.

5.3.2 Visitor Dosimetry

Visitors within an RCA shall receive, as a minimum, a low range 0-200 mR Pocket Ionization Chamber (PIC).

Visitor TLD results are recorded on the Site Registration Form, GPI26-1, which is maintained at the facility. When a visitor is issued a TLD, the individual's name, social security number, issue date, and date of return will also be recorded on the Monthly Dosimetry Issue Log.

5.4 Lost, Damaged or Questionable Dosimetry

In the event of a Lost, Damaged or Questionable TLD or PIC, the Project Manager or designee shall be notified immediately. A Lost, Damaged or Questionable Dosimetry Report, (GPI Form 26-2) will be completed and filed in the individual's exposure file. The dose estimated from all exposure received while the individual was in an exposure situation must be determined and recorded in the individuals' dose record.

In the event of multiple occurrences, the RSO shall be notified immediately.

5.5 Dropped or Off-Scale Personal Ion Chambers

If a PIC is dropped or if it's hairline is no longer visible (off-scale), the response of this device is no longer valid and an

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estimate of the dose received by an individual must be made based on; dose rates and time in the work area, typical dose received on that type of job, or the dose received by another person doing the same type of work in the same area. A Lost, Damaged or Questionable Dosimetry Report, GPI26-2, shall be used to document this type of situation. The dose determined shall be added to the dose record at the discretion of the Radiation Safety Officer. The Radiation Safety Officer shall review, approve, and maintain all completed dose estimates.

5.5 PROJECT DOSIMETRY ISSUANCE/CONTROL

5.5.1 Prior to project commencement, the Project Manager and RSO will determine the appropriate radiation monitoring dosimetry required in accordance with the GPI Health and Safety Manual. The Project Manager or designee will contact the GPI Technical Support Office and provide them with the following information:

- GPI Project Name and Account Number
- Project start date and projected duration
- Appropriate dosimetry required for project
- Number of dosimetry requested
- Name, address, social security, birth date of project personnel to be monitored.
- Address dosimetry is to be shipped to.

5.5.2 Personnel assigned to projects will wear the appropriate dosimetry for no more than one month or the duration of the project, whichever is shortest.

It will be arranged at the time of initial project TLD order by the Technical Support Office as to how many month's supply of dosimetry will be required for the project. It will be the responsibility of the Project Manager or designee to return dosimetry to the vendor for processing at the end of each monthly monitoring period.

If the original projected project duration is extended, the Project Manager or designee shall inform the Technical Support Office so that the proper arrangements can be made to supply additional dosimetry from the vendor.

5.5.3 Dosimetry Processor (Vendor)

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The dosimetry vendor must be NVLAP certified and be in accordance with the project Health and Safety Plan.

Upon receiving project dosimetry, the Project Manager or designee shall verify that the dosimetry received meets the requirements of the project. Any problems should be reported to the Technical Support Office, Las Vegas for immediate attention and resolution. All documentation received with dosimetry will be filled out completely. When all required preliminary training and documentation has been completed as described in the project Detail Work Procedure, dosimetry will be issued to project personnel.

It is the responsibility of the Project Manager or designee to ensure that form GPI26-3, Dosimetry Issue Log is completed at the time of dosimetry issuance and a copy is sent to the Technical Support Office, Las Vegas, NV.

6.0 Quality Control

Pocket Ion Chambers (PIC's) shall be calibrated by a certified laboratory or validated procedure every six months when in use.

7.0 Records

7.1 The following records are completed by this procedure and shall be maintained as specified in the project Quality Assurance Plan.

- 7.1.1 GPI26-1, Site Registration Form
- 7.1.2 NRC Form 4
- 7.1.3 GPI26-2, Lost, Damaged or Questionable Dosimetry Report
- 7.1.4 GPI26-3, Dosimetry Issue Log
- 7.1.5 GPI26-4, Radiation Exposure Record
- 7.1.6 GPI26-5, Occupational Radiation Exposure History

7.2 Radiation Work Permits

All personnel working in a radiologically controlled area must be assigned to a specific Radiation Work Permit (RWP), (GPI6-1) applicable to the job being performed. A Radiation Work Permit Access Log, (GPI6-2) will be attached to each RWP.

All personnel assigned to a job requiring an RWP shall sign the Access Log prior to starting work, indicating time in and starting PIC dose. Upon completion of the work or at the end of the shift, personnel shall sign out on the Access Log, indicating time out and the current PIC dose.

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7.3 Weekly Available Exposure Report

A weekly accumulated estimated exposure report will be maintained and posted for employee review at the start of each work week. This report will reflect a running total of exposure available for the current calendar quarter. The beginning quarterly available exposure will be 1250 mRem for those individuals with a completed and signed Occupational Exposure History Form.

7.4 Occupational Radiation Exposure History Letter

An Occupational Radiation Exposure History Letter, (GPI Form 26-5) will be completed for all personnel for whom permanent exposure results have been obtained. Copies of this letter will be sent to the individual, and maintained in the individual's personnel exposure file by the GPI Technical Support Office, Las Vegas, NV. For current employees, this letter will be completed annually. For former employees, this letter will be completed and mailed within thirty working days after results have been obtained.

Any time GPI is required to report an individual's exposure to the Nuclear Regulatory Commission or other Regulatory Agency, a copy of the report will be sent to the individual.

7.5 Project Records/Documentation

Upon completion of the project, it will be the responsibility of the Project Manager or designee to forward all project records, logs, and communications regarding personnel exposure, exposure records, dosimetry records, and all other pertinent information about personnel dosimetry and individual radiation protection for RSO review, and filing in anticipation of NRC review.

8.0 References

GPI-6	Issuing and Using Radiation Work Permits
GPI-8	Radiation and Contamination Surveys
GPI-19	Training
GPI-RSM	GPI Radiation Safety Manual
GPI-RSTM	GPI Radiation Safety Training Manual

9.0 Attachments

GPI26-1	Site Registration Form
NRC Form 4	
GPI26-2	Lost, Damaged or Questionable Dosimetry Report
GPI26-3	Dosimetry Issue Log
GPI26-4	Radiation Exposure Record
GPI26-5	Occupational Exposure History

Gutierrez-Palmenberg, Inc.  
Las Vegas, Nevada

*Lost, Damaged or Questionable Dosimetry REPORT*

<i>Administrative</i>	
REPORT DATE/TIME:	
INDIVIDUAL'S NAME:	
BADGE NUMBER:	
DATE/TIME OF INCIDENT:	
LOCATION IF KNOWN:	
APPLICABLE RWP NO.:	
DATE BADGE WAS ISSUED:	
<i>Dose Calculation</i>	
1.	Dose from dosimeter readings (Total from date issued) thru _____ (Date) = _____ mrem
2.	Current dosimeter reading: (If more than one dosimeter, use highest) = _____ mrem
3.	If individual was not wearing a dosimeter, or lost his dosimeter, assign highest exposure received by workers in the same area. If none, use dose rate x time in area for the same period.  Dose Rate _____ (mrem/hour) x Time _____ (hours) = _____ mrem
4.	Total estimated exposure to be assigned: _____ = _____ mrem
THE METHOD USED TO ESTIMATE MY EXPOSURE HAS BEEN EXPLAINED TO ME, AND THE ESTIMATED DOSE ASSIGNED TO MY RECORD IS ACCEPTABLE FOR THIS EVENT.	
EMPLOYEE'S SIGNATURE: _____	DATE: ____/____/____
<i>Dose Record Authorization</i>	
Dose Estimate Calculations by: _____	DATE: ____/____/____
Dose Estimate Reviewed by: (RSO) _____	DATE: ____/____/____

## RADIATION DOSIMETRY ISSUE LOG

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Gutierrez-Palmenberg, Inc.  
Las Vegas, Nevada

RADIATION EXPOSURE RECORD

NAME:	Social Security Number:
BIRTH DATE:	
LIFETIME WHOLE BODY DOSE EQUIVALENT: _____ (REM)	
TLD BADGE NO:	
PIC NO:	Monitoring Year: 19 _____

Monitoring Period	Whole Body Dose (DDE)	Shallow Dose (SDE)	Extremity Dose (SDE)	Eye Dose (EDE)	Organ Dose (CDE)	Internal Effective Dose (CEDE)	Total Effective Dose Equivalent - REM (DDE + CEDE)
January							
February							
March							
April							
May							
June							
July							
August							
September							
October							
November							
December							

Notes:
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Gutierrez-Palmenberg, Inc.  
Las Vegas, Nevada

OCCUPATIONAL RADIATION EXPOSURE HISTORY

NAME:	SSN:
ADDRESS:	
DATE OF BIRTH:	

THE ABOVE INDIVIDUAL WAS MONITORED BY:

TLD: ☐

POCKET ION CHAMBER: ☐

MONITORING BADGE NUMBER: \_\_\_\_\_

THE MONITORING PERIOD WAS:

FROM: \_\_\_\_\_ TO: \_\_\_\_\_

THE OCCUPATIONAL RADIATION EXPOSURE WAS RECEIVED DURING HIS/HER

ASSIGNMENT FOR: Gutierrez-Palmenberg, Inc.

ADDRESS: Suite 580, 333 North Rancho Drive

CITY/STATE/ZIP: Las Vegas, NV 89106

TELEPHONE: 702/647-5699 PROJECT: \_\_\_\_\_

RADIATION EXPOSURE RESULTS:

DEEP DOSE EQUIVALENT FOR THE PERIOD STATED ABOVE: \_\_\_\_\_ REMS (DDE)

SHALLOW DOSE (Skin) FOR THE PERIOD STATED ABOVE: \_\_\_\_\_ REMS (SDE)

EXTREMITY DOSE FOR THE PERIOD STATED ABOVE: \_\_\_\_\_ REMS

EYE DOSE EQUIVALENT FOR THE PERIOD STATED ABOVE: \_\_\_\_\_ REMS (EDE)

COMMITTED EFFECTIVE DOSE EQUIVALENT (INTERNAL) : \_\_\_\_\_ REMS (CEDE)

TOTAL EFFECTIVE DOSE EQUIVALENT (DDE + CEDE): \_\_\_\_\_ REMS

THIS REPORT IS FURNISHED TO YOU UNDER THE PROVISIONS OF NUCLEAR  
REGULATORY COMMISSION REGULATION 10 CFR PART 20 TITLED "STANDARDS FOR  
PROTECTION AGAINST RADIATION". YOU SHOULD PRESERVE THIS REPORT FOR  
FURTHER REFERENCE.

RADIATION SAFETY OFFICER: \_\_\_\_\_ DATE: \_\_\_\_\_

