

**DEFENSE THREAT REDUCTION AGENCY**  
**NUCLEAR TEST PERSONNEL REVIEW PROGRAM**  
**RADIATION DOSE ASSESSMENT**

**STANDARD OPERATING PROCEDURE**  
**RA04 – Internal RDA Reviews**

**Revision 1.3**

Key to SOP ID Codes

*RA (Radiation Assessment - SOP)*  
*ED (External Dose - Standard Methods)*  
*ID (Internal Dose - Standard Methods)*  
*UA (Uncertainty Analysis - Standard Methods)*



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## **Standard Operating Procedure**

### **RA04 – Internal RDA Reviews**

#### **1 Purpose/Summary**

This standard operating procedure (SOP) provides the detailed activities and tasks required to conduct internal reviews of radiation dose assessments (RDA) for Nuclear Test Personnel Review (NTPR) Program participants (generally veterans). These reviews are an essential element of the NTPR quality assurance and quality control process guaranteeing that assessments are carried out according to the standard operating procedures and standards methods described elsewhere in this procedures manual.

This SOP is written for qualified radiation dose analysts who perform detailed quality control of radiation dose assessments, and for managers who oversee the entire dose assessment process to assure conformance with procedures, methods, quality standards of assessment products, and established NTPR policies and guidelines.

#### **2 Scope**

This SOP applies to all radiation dose assessments prepared according to SOP RA01. It stipulates a multi-layered quality control and quality assurance process that guarantees the application of approved standard procedures and methods, and all documented data and information. It assures that all aspects of radiation dose calculations are addressed to satisfy the requirements of Title 32, Code of Federal Regulations (CFR), Part 218, *Guidance for the Determination and Reporting of Nuclear Radiation Dose for DoD Participants in the Atmospheric Nuclear Test Program*, DTRA's NTPR Program - *Quality Plan* (DTRA, 2009a) and DTRA's NTPR Program - *Program Management Plan* (DTRA, 2009b). The review process specified in this SOP assures that radiation dose assessments provide full consideration of benefit of the doubt as implemented in response to DTRA's guidance for assuring consistency with Department of Veterans Affairs (38CFR3.102) requirements.

#### **3 Responsibilities**

Internal reviews are carried out by peer reviewers from the radiation dose assessment team and managers. Analysts perform technical reviews to verify all aspects of the assessment and check for errors. Analysts are qualified technical staff experienced in carrying out similar assessments and trained in all procedures and methods relevant to the cases that they review. Certified Health Physicists (CHP) are responsible for reviewing the soundness and correctness of the radiation exposure scenarios and dose results. They provide a second layer of error checking for complex cases and cases for which new dose calculation tools are developed. Finally, RDA process managers are in charge of the final internal management review to assure compliance and uniformity across all assessments.

## **4 Definitions**

**SPARE** A document with detailed information on an NTPR participant's activity scenario during involvement in the U.S. atmospheric nuclear testing program or occupation of Japan.

## **5 Procedure: Detailed Activity/Task Description**

A dose assessment accomplishes the analyses needed to estimate all relevant radiation dose components. The final product of the dose assessment is the RDA Report, supporting calculation worksheets, and additional analyst notes.

The primary dose assessment analyst prepares estimates of the doses for all identified exposure scenario elements derived from the SPARE as supplemented by any comments from the participant. The analyst uses appropriate calculation methods to estimate the doses and corresponding uncertainties. The analyst then prepares a first draft of the RDA Report, which provides a description of the participant's activities, radiation environments encountered, assumptions, and resulting doses and upper bounds (using estimates of uncertainties). Once the first draft is prepared, an iterative review comment and revision process is performed as described below.

### **5.1 Technical Review**

The technical review is conducted by one or more dose reconstruction analysts other than the primary analyst. More than one reviewer is needed when specialized expertise is required for complex cases or specific parts, for example for cases where the veteran participated in several test series (operations). Technical reviewers can be consulted by the primary analyst for advice and assistance during the development of the draft RDA Report.

The primary analyst provides the first draft of the RDA Report with the complete case file (request, SPARE, documentation, dose calculation worksheets, notes, and other information) to a qualified dose reconstruction analyst (or analysts) for a thorough review of the facts of the case, and a detailed technical review for accuracy, correctness, and conformance with NTPR dose assessment procedures, methods and requirements. The technical reviewer uses the Technical/CHP Review Checklist for NTPR Radiation Dose Assessments (Attachment 1) to guide the review and to record the results.

The primary analyst reviews all comments, carries out discussions with the reviewer(s) as needed, resolves all comments satisfactorily, and prepares a revised draft RDA Report.

### **5.2 CHP Review**

The CHP review is performed by a member of the dose assessment team who is a Certified Health Physicist (CHP). After addressing the comments of the technical reviewer(s), the primary analyst submits the revised draft RDA Report to a CHP on staff

for a thorough professional review. CHP reviewers can be consulted by the primary analyst for advice and assistance during the development of the draft RDA Report.

The CHP reviews the soundness and correctness of the radiation exposure scenarios and dose results. The CHP also provides a second technical review layer by double-checking for errors, particularly for complex cases and cases for which new dose calculation tools are developed. The CHP uses the Technical/CHP Review Checklist for NTPR Radiation Dose Assessments (Attachment 1) to guide the review and to record the results.

The primary analyst reviews the comments, makes appropriate revisions, and receives final CHP approval. A revised draft RDA Report is then submitted for management review and approval.

**Note:** In certain cases, usually for simple RDA cases, the technical and CHP reviews may be combined and performed by a CHP.

### **5.3 Management Review**

The management review is performed by the dose assessment contractor Program Manager or designee who oversees the dose assessment team. After addressing the comments of the CHP reviewer and obtaining approval, the primary analyst submits a revised draft RDA Report to the dose assessment manager for the final internal management review. The management reviewer can be consulted by the primary analyst for guidance on process and program compliance issues during the development of and revision of the draft RDA Report.

The dose assessment contractor's Program Manager or designee reviews the revised draft RDA Report and supporting documentation to determine that it addresses the requirements of the case, fully considers the participant's comments, conforms to DTRA NTPR guidance, and is complete. The management reviewer appraises the overall soundness of the dose assessment and exposure scenarios, and evaluates the entire assessment for conformance with procedures, methods, quality standards, and established NTPR policies and guidelines. The management reviewer also checks for consistency and uniformity across all assessments.

The primary analyst reviews all comments and suggestions of the management reviewer, resolves all comments satisfactorily, and prepares a final RDA Report for out-processing and submission to DTRA for review, approval and sign out.

### **5.4 Revisions Following External Reviews**

DTRA selectively or routinely conducts external reviews or audits of RDA cases. As directed by DTRA, the dose assessment team will address specific comments formulated by the external reviewer.

External reviews are performed according to the DTRA NTPR- Program Quality Plan (DTRA, 2009a). The dose assessment contractor team revises the RDA Report and supporting calculations in response to significant comments emanating from the external review. When revisions affect the estimated doses and upper bound estimates, a second

CHP review is carried out. The revised RDA Report then undergoes a second management review. Once all additional comments are addressed and incorporated, a final RDA Report is re-submitted to DTRA for approval and sign-out.

For the purpose of this procedure, external reviews are conducted by qualified radiation dose analysts who are not part of the dose assessment contractor team. Significant comments are those that impact major elements of information provided in the RDA Report, and those that materially affect the dose calculation results in a manner that is not already built-in the uncertainty calculations.

## **6 Data and Records Management**

A Technical/CHP Review Checklist for NTPR Radiation Dose Assessments (Attachment 1) is completed by each technical or CHP reviewer. The checklist helps the reviewer to account for all elements that require to be checked. The completed reviewer checklists are included in the case file.

In addition, each step of the RDA development and internal review process is tracked and recorded in the NTPR Dose Assessment Internal Tracking and Quality Assurance Checklist (Attachment 2). Reviewers document the completion of each review by inserting the date of the review and affixing their initials. A copy of the checklist is transmitted to the Enterprise Manager with the completed file. Another copy is kept in the case file.

Official copies of final RDA Reports, supporting dose calculations, and supporting information are maintained by the Enterprise Manager according to the DTRA NTPR Program Management Plan (DTRA, 2009b).

## **7 Quality Control and Quality Assurance**

The internal review process is based on both technical and process requirements. Technical review requirements are guided by the science behind radiation dose assessments. The management review requirements are essentially driven by the NTPR Program policy and guidance, which in turn are based on regulatory and legal provisions.

This procedure assures that RDA reports are prepared and reviewed according to the most up-to-date program requirements published in revisions of the DTRA NTPR Program - Program Management Plan (DTRA, 2009a) and mirrored in revisions of this Standard Procedures Manual and the DTRA NTPR - Program Quality Plan (DTRA, 2009b).

### **7.1 Technical Reviews**

As new methods, techniques, and supporting data are adopted, the standard methods found in this manual will be updated to reflect such changes. As trained analysts, technical reviewers stay abreast of new approaches and are fully involved in implementing new scientific and technical methods. When changes in technical methods

are adopted, dose assessment analysts are informed of and trained in the proper use and review of radiation dose assessments as affected by the newly approved methodologies.

## **7.2 Management Reviews**

Management review of radiation dose assessments are essentially performed to check for conformance to the NTPR programmatic and regulatory requirements. Management reviewers are immediately informed of updates of the NTPR Policy and Guidance Manual reflecting any changes adopted by DTRA in any aspects of the dose assessment process. Changes affecting dose assessments are incorporated in revisions of the appropriate standard procedures and methods included in this manual. Dose assessment analysts immediately review the changes in the NTPR Policy and Guidance Manual and are trained in the implementation of any amendments to the standard procedures and methods affected by the updated guidelines.

## **8 Referenced SOPs and Standard Methods from this Manual**

- (1) SOP RA01 - Radiation Dose Assessment for Cases Requiring Detailed Analysis

## **9 Reference Materials**

- (1) DTRA (Defense Threat Reduction Agency), 2009a. DTRA NTPR Program - Quality Plan (Fort Belvoir, VA) (February 28).
- (2) DTRA (Defense Threat Reduction Agency), 2009b. DTRA NTPR Program - Program Management Plan (Fort Belvoir, VA) (April 30).

## **Attachment 1    Technical/CHP Review Checklist for NTPR Radiation Dose Assessments**

A copy of the “Technical/CHP Review Checklist for NTPR Radiation Dose Assessments” is provided starting on the next page.

## Technical/CHP Review Checklist for NTPR Radiation Dose Assessments

Participant's Name: \_\_\_\_\_ Operation(s): \_\_\_\_\_

Primary Analyst(s): \_\_\_\_\_ RDA Draft Date: \_\_\_\_\_

Reviewer: \_\_\_\_\_ Type: Select one Date: \_\_\_\_\_

### 1. Information in the Request Cover Letter

- \_\_\_ Disease/Target Organ
- \_\_\_ Additional comments

### 2. Information in SPARE

- \_\_\_ Veteran's recollections and response comments relative to scenario
- \_\_\_ General activity scenario (verify with case file information if needed)
- \_\_\_ Adequate discussions (e.g., hours/day of various activities, etc.)
- \_\_\_ Note any unusual features of scenario (e.g., multiple operations or unusual activities that involve potential for exposure)
- \_\_\_ Note veteran's checkmark and signature date

### 3. Radiation Dose Assessment Report

#### General items

- \_\_\_ Consistency of RDA with SPARE (e.g., veteran's name, scenario, details)
- \_\_\_ Veteran's comments addressed.
- \_\_\_ Verify that RDA contains adequate description of exposure pathways and sufficient explanations of "Scientific Principles and Studies" (if not in SPARE), or provide appropriate references
- \_\_\_ References are cited correctly, and are complete
- \_\_\_ Doses are summed and tabulated correctly and reported in accordance with DTRA guidelines
- \_\_\_ Upper-bound doses are calculated correctly (e.g., proper assumptions and methodology for dependence/independence of doses and use of quadrature methodology) and reported properly (e.g., doses accrued in different operations are reported separately in the up-front summary table).
- \_\_\_ Note any typos or other errors (e.g. veteran's name, service number, service, rank, grade, etc.)

#### External Dose Assessment

- \_\_\_ Film badge data - are readings and periods of coverage cited and used correctly; are film evaluations done and reasonable assumptions incorporated for damaged and missing badges
- \_\_\_ Check accuracy of partial and summed doses (per calculation files)
- \_\_\_ Check that non-generic exposures are reasonably assessed

#### Internal Dose Assessment

- \_\_\_ Correct dose quantity calculated for appropriate organ/tissue per disease or as requested
- \_\_\_ All appropriate exposure pathways are included
- \_\_\_ Parameter values are correctly cited and used in calculation files
- \_\_\_ Basis is stated for each non-standard assumption or parameter value
- \_\_\_ Verify that magnitude of doses is reasonable

Skin Dose Assessment

- \_\_\_ Parameter values are correctly cited and used in calculation files
- \_\_\_ Non-standard exposure pathways are reasonably assessed
- \_\_\_ Magnitude of surface-deposited beta dose is reasonable, based on associated gamma doses
- \_\_\_ Appropriate and correct assessment of dermal contamination doses

**4. Calculation files**

- \_\_\_ Check for accuracy of doses as derived (e.g., Mathcad, Excel, Mathematica, XRD, FBDOSE2), especially for use of proper parameter values
- \_\_\_ Calculations are organized and explained so that they can be followed during reviews/audits.

**5. Additional Comments:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## **Attachment 2 RDA Internal Tracking and Quality Assurance Checklist**

A model copy of the NTPR Dose Assessment Internal Tracking and Quality Assurance Checklist is provided on the next page.

## Nuclear Test Personnel Review Dose Assessment Internal Tracking and Quality Assurance Checklist

Participant's Name: \_\_\_\_\_ Operation(s): \_\_\_\_\_

Primary Analyst(s): \_\_\_\_\_ Case Completion Date: \_\_\_\_\_

ACTION	COMPLETION DATE	PERFORMED BY
<b>Pre- Assessment</b>		
Dose Assessment Request (Case) Received from Enterprise Manager L-3 Titan		
Case Tracking Tools Updated		
Pre-Assessment Review by Principal Analyst		
Case Assigned to Primary Analyst		
<b>Dose Assessment Development</b>		
First Draft RDA Report*		
Technical Review		
Final CHP Review		
Management Review *		
Assessment Report Package Sent to L-3 Titan (Contractor Case Completion Date) *		
Review External QA Comments, if Received *		
Revise Report to Address QA Comments		
2 <sup>nd</sup> CHP Review (If Dose Calculations Are Affected)		
2 <sup>nd</sup> Management Review		
Revised Assessment Report Package Sent to L-3 Titan *		
<b>Post- Assessment (Closeout)</b>		
DTRA Sign-Out Notice Received (Completion Date)		
File Submitted for Closeout		
Case Tracking Tools Updated		
Contractor Dose Database System Updated		
Dose Data Sent to L-3 Titan for NuTRIS Update		
Hardcopy Case Folder Created and Filed		
* Make Appropriate Case Tracking System Update.		
Note: Review completion dates reflect when closure is reached between the primary analyst and the reviewer; may involve several iterations.		
Comments:		