# Radiation Dose Assessments in the NTPR Program

***VBDR Meeting: March 7-8, 2007***

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# Briefing Outline

- **Radiation Dose Assessment (RDA) Overview**
- **Hierarchy of Guidance**
- **Procedural Hierarchy**
- **NTPR Case Processing Model**
- **RDA Processing Model**
- **The Non-Generic RDA**
- **The Generic RDA (cohort based)**
- **The Road Ahead**

- **Projected Briefing Time: 30 minutes**

# Overview

- **Purpose**
  - Describe the detailed process for preparing the NTPR RDA Report
- **SOP Status**
  - Draft form (November 2006)
  - Scheduled for completion in the summer of 2007
- **RDA Reports are prepared for:**
  - Japanese-held prisoners of war or occupation forces located near Hiroshima and Nagasaki
  - Atmospheric nuclear test participants (1945 – 1962) and non-participants as requested by DVA
- **In response to requests from:**
  - DVA, individuals, approved parties

# Hierarchy of Guidance

- **Code of Federal Regulations**
  - 32 CFR 218 (DoD - Principal Regulatory Guidance)
  - 38 CFR 3.102 (DVA - Benefit of the doubt)
  - 38 CFR 3.311 (DVA Non-Presumptive) and 38 CFR 3.309 (DVA Presumptive): Not guidance but have significant influence on the program
- **DTRA Policy and Guidance (P&G) Manual**
- **Quality Plan (Describes Quality Management system)**
- **Standard Operating Procedures (SOP) Manual**

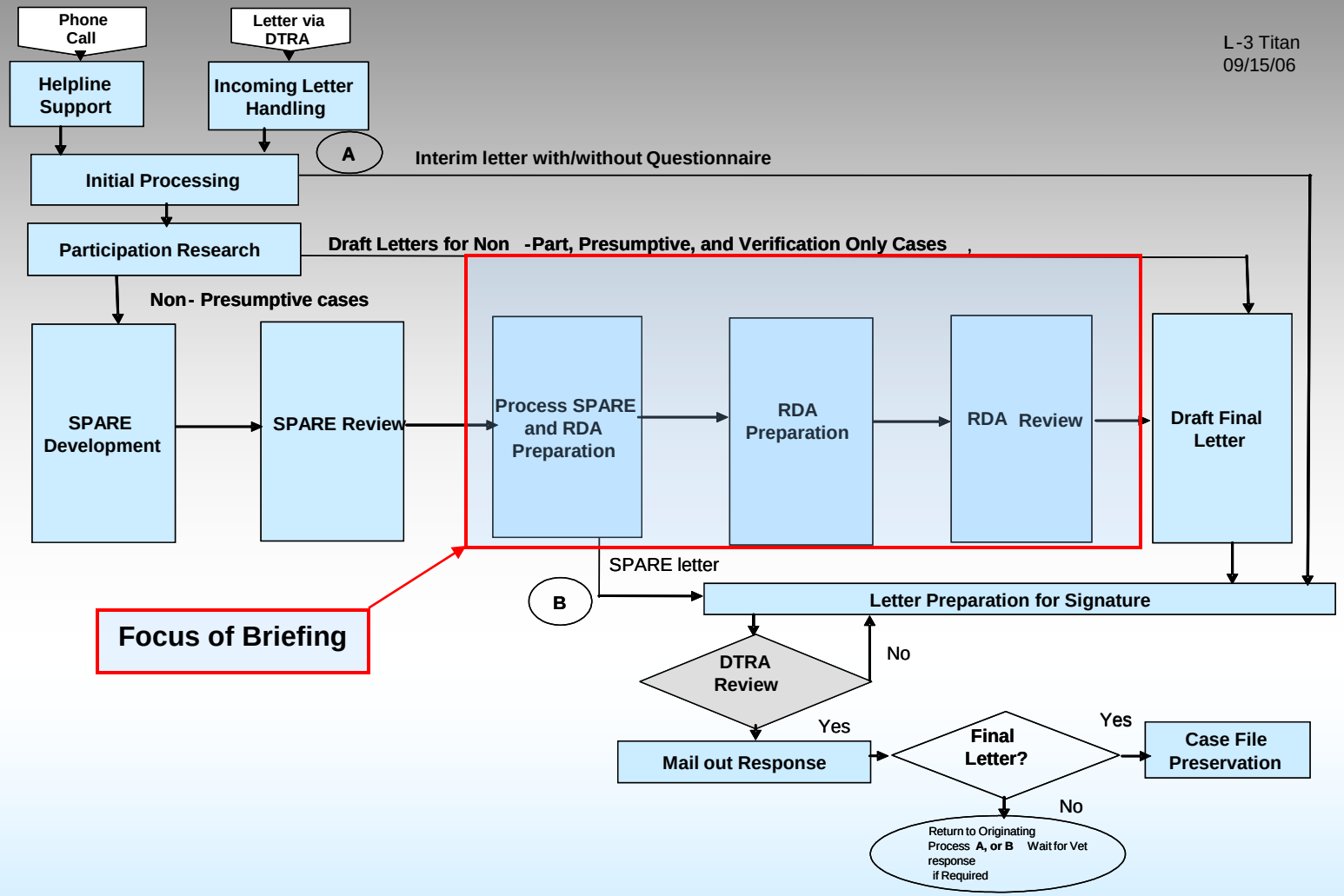
# Procedural Hierarchy

- **Standard Operating Procedures**
  - Detailed work instructions, activity steps, responsibilities, quality control and quality assurance, record management
- **Standard Methods (SMs) Provide:**
  - Analytical methods, techniques, calculation tools; citations for technical information and scientific basis
- **Operation/Shot-Specific Information Appendices (A – C)**
  - Detailed data on radiation environments
  - Assumptions
  - Numerical parameters
- **Compendium of References (Appendices D-G)**

# Standard Operating Procedures

- **Ensure that RDAs:**
  - Follow a standard process
  - Use consistent methodologies with reproducible results
  - **Provide sufficient information for the DVA to make sound compensation decisions (Key)**
  - Consider all relevant information, technically sound methods, appropriate assessment of uncertainty
  - Produce quality reports: error-free, timely, appropriate level of documentation
  - Reflect benefit of the doubt consistent with DTRA policy and guidance, DVA requirements (38 CFR 3.102)

# NTPR Case Processing Model



# Case Processing Model

- **Scenario of Participation and Radiation Exposure (SPARE)**
  - Characterizes the veterans activities in space and time (what they did and when and where they did it)
  - Veteran reviews and comments
- **RDA Report Preparation and Review**

# Radiation Dose Assessment

- **RDA Report Definition**
- **RDA Required For Claims not handled through DTRA's Expedited Processing Methods:**
  - Presumptive radiogenic diseases where the claim was filed prior to the disease being designated as presumptive
  - Non-presumptive radiogenic diseases
  - Non-radiogenic diseases
    - competent scientific or medical evidence that claimed condition is radiogenic

*RDA Reports are prepared according to:*

***RDA Process Flow***

# Non-Generic RDA

- **Governed by:**
  - SOP RA02, Radiation Dose Assessment for Non-Generic Cases
- **Requires:**
  - Adapted dose assessment tools, new calculation modules
- **Tailored to:**
  - Specific activities, radiation environments
  - Organs, anatomical locations (skin/eye)
- **Quality Assurance Considerations**
- **Greater Potential for Exposure**

# Non-Generic RDA

- **Review SPARE and Case File and Confirm Status**
  - Required information available?
  - Identify conflicts, inconsistencies
  - Non-generic status?
  - Collect additional information if needed
- **Requires:**
  - SPARE (preferably reviewed and signed by the veteran)
  - Complete case file

# Non-Generic RDA

- **Identify Exposure Scenario and Define Exposure Pathways**
  - **Key step (where you need to get it right!)**
  - **Characterize radiation environment**
    - Initial radiation
    - Residual radiation
  - **Identify significant exposure activities**
    - Temporal and spatial relationship to the radiation environment

# Non-Generic RDA

- **Assess Whole-Body External Dose**
  - Basis for skin/eye, internal (surface-deposited sources)
  - **Hierarchy of methods (32 CFR 218)**
    - Personal dosimetry (film badge) (SM ED01)
    - Cohort dosimetry
    - Reconstruction
      - Dosimetry unavailable or unreliable (criteria)

# Non-Generic RDA

- **Reconstructed Whole Body Doses**
  - Assumptions and numerical parameters
  - Dose estimates (SM ED02, Appendices A-C)
    - **Initial gamma, neutron**
      - **Depends on:** Distance, posture, shielding, atmosphere
      - **Based on:** Technical reports, transport codes
    - **Residual gamma**
      - **Depends on:** temporal/spatial relationship to radiation environment
      - **Based on:** SPARE, technical reports, measurements, historical records

# Non-Generic RDA

- **Total External and Upper Bound Doses**
  - **Gamma, neutron** (Film badge plus reconstructions)
  - **Upper bound (SM UA01)**
    - Identify uncertainties
      - Independent and dependent sources
      - Uncertainty factors (DTRA P&G, NAS 1989)
    - Combine uncertainties to get total uncertainty increment
    - Upper Bound = mean plus uncertainty increment

# Non-Generic RDA

- **Assess Internal Dose**
  - **50-year Committed Equivalent Dose (CED) to organs/tissues**
  - **Published DCFs (32 CFR 218)**
    - Recent ICRP models
    - Surrogates
  - **Pathways**
    - Inhalation
      - Descending fallout
      - Suspended/resuspended contaminants
      - Atmospheric cloud
    - Ingestion
    - Absorption (skin or wound)

# Non-Generic RDA

- **Calculate Organ Doses (SM ID01)**
  - Alpha and beta plus gamma separately
  - Each organ and pathway
  - Shot-specific DCFs (FIIDOS)
  - Tabulated values simplify calculations
    - Rem (CED)/curie
    - Rem (CED)/rem (FBE)
  - Totals and upper bounds (SM UA01)

# Non-Generic RDA

- **Organ Dose – Benefit of Doubt is Ensured by:**
  - Full exposure –descending fallout
  - Ingestion – peak rate of deposition
  - “Maximum dose” DCFs
  - Inventory depletion - radiological decay only
  - High-sided resuspension factors
  - Uncertainty factor of 10 (RBE, models)

# Non-Generic RDA

- **Assess Skin Dose**
  - **Beta plus gamma (and neutron)**
  - **Expedited processing (DTRA)**
    - All except H&N (and others on case by case basis as determined by DTRA)
  - **Principal pathways**
    - Surface deposited fallout and point sources (SM ED03)
    - Dermal contamination (SM ED04)

# Non-Generic RDA

- **Gamma Doses to the Skin**
  - Same as whole body gamma
- **Beta Doses to the Skin**
  - Assumptions and estimates
    - Beta to gamma ratios (beta “shine”)
    - Shielding, posture, geometry
    - Anatomical location
    - Direct contamination

# Non-Generic RDA

- **Skin Dose Calculations**
  - Surface-deposited (SM ED03)
  - Dermal contamination (SM ED04)
- **Totals and Upper Bounds**
  - Each exposure type and skin location
  - Upper bound (SM UA01)

# Non-Generic RDA

- **Assess Eye Lens Dose**
  - **DTRA is considering Expedited Processing for eye lens**
  - **Beta plus gamma (and neutron)**
  - **Principal pathways**
    - Surface deposited fallout (SM ED05)
      - Same approach as for skin dose
      - 3000 μm for eye lens vs. 70 μm for skin
    - Dermal contamination (SM ED04)
      - Eyelid and orbit (ratios of lens to skin dose)
  - **Upper bound (SM UA01)**

# Non-Generic RDA

- **Prepare Draft RDA Report**
  - Dose results, scenario, assumptions
- **Internal Quality Reviews**
  - Technical, CHP, Management
  - Tracking form
- **Prepare Final RDA Report**
- **Transmit to Enterprise Manager**

# Non-Generic RDA

- **Quality Control and Assurance**
  - Calculation tools and templates
  - Internal review
  - External review (not part of DR Team)
  - Audits
  - Official copies retained by Enterprise Manager

# Generic RDA

- **Variant of the Non-Generic RDA**
- **Cohort Approach**
  - Activity scenario (large # participants)
  - Radiation environment (well defined)
- **Standardized:**
  - Assumptions, tools, templates
- **Improved Efficiency**
- **Comprehensive Documentation**

# Generic RDA

- **Templates, Tools Available for:**
  - **Hiroshima and Nagasaki**
  - **Oceanic test series**
  - **Nevada Test Site (under development)**
    - Observers, Maneuver troops

# Generic RDA

- **Calculation Input**
  - Arrival and departure
  - Time weighted shielding factor (TWSF)
  - Dosimetry (evaluate veracity)
  - Periods for reconstruction
  - Posture, geometric considerations (skin, eye)
  - Target organ(s)

# Generic RDA

- **Generic RDA Report Templates**

  **Placeholders for:**

  - Target organs, skin cancer locations
  - Response to veteran's comments (SPARE)
  - Parameters, assumptions
  - Personal information

- **QA/QC and Case Processing same as for Non-Generic RDA**

# The Road Ahead

- Finalize SOPs, Standard Methods, Appendices
- Develop Library of Technical Basis Documents
- Complete Templates for NTS Operations
- Identify Additional Categories for Possible Expedited Processing or Generic RDA
- Rigorous Uncertainty Analysis
  - Supplant UB Factors with Probabilistic Uncertainty Analysis (Monte Carlo)

# Questions?