

DTRA POINT PAPER FOR VBDR REVIEW

ANALYSIS OF EXPEDITED PROCESSING FOR POTENTIALLY RADIATION-INDUCED CATARACT FORMATION IN VETERAN COMPENSATION CASES

BACKGROUND

A cataract is a clouding of the lens in the eye that affects vision. Cataracts differ in their location within the eye, their pathogenesis, and to some extent, their clinical presentation. Most cataracts are related to the natural aging process, compounded by individual health, activities and environmental conditions. By age 80, more than half of all Americans have a cataract or have had cataract surgery.¹ Age-related (aka senile) cataracts are multifactorial, unlike congenital or traumatic cataracts. There are three major types of senile cataracts with approximate relative occurrence in groups 75 years and older as follows: nuclear (two thirds), cortical (one fourth), and posterior subcapsular (one fifth).²

Under Title 38, Code of Federal Regulations, Part 3.311, a dose must be estimated or reconstructed for all Department of Veterans Affairs (VA) radiation-related compensation cases involving posterior subcapsular cataracts (PSC) and DTRA is tasked with providing individual radiation dose assessments (RDAs) to VA. As a result of the National Research Council (NRC)³ review of DTRA's dose reconstruction program, VA has returned over 1,250 previously-completed cases to DTRA for reassessment. Five percent of these reassessments involved cataract formation potentially induced by radiation exposure.

Early detection of the onset or presence of cataracts has improved markedly in the past decade. Radiogenic cataract formation is deterministic in nature, with the therapeutic threshold dose for cataract formation in the range of 130-200 rad.⁴ Published long term studies of Hiroshima and Nagasaki nuclear blast survivors⁵ and nearer term Chernobyl accident victims⁶ cite measurable changes in color and opacity for eye doses ranging from 15 to 25 rad, respectively.

¹ "Cataracts What you should know," National Eye Institute of the National Institutes of Health, Information Office, Bethesda, MD; NIH Publication No: 03-201, Septmeber 2003; available at: <http://www.nei.nih.gov/health/cataract/webcataract.pdf>.

² Ocampo, V.V. and Foster, C.S., "Cataracts, Senile," updated September 15, 2005, available from www.eMedicine.com at <http://www.emedicine.com/oph/topic49.htm>.

³ Committee to Review the Dose Reconstruction Program of the Defense Threat Reduction Agency, National Research Council, A Review of the Dose Reconstruction Program of the Defense Threat Reduction Agency, National Academy Press, Washington D.C., 2003.

⁴ Hall, Eric J. and Giaccia, Amato J., Radiobiology for the Radiologist, Sixth Edition, "Chapter 13: Radiation Cataractogenesis," Lippincott Williams & Wilkins, Philadelphia PA, 2006.

⁵ Walker, R.I., Cerveny, T.J. and Alt, L.A., (eds.), Medical Consequences of Nuclear Warfare, TMM Publications, Office of the Surgeon General, Bethesda MD[1989]. In particular, Walden, T.L., "Chapter 9: Long Term and Low Level Effects of Radiation."

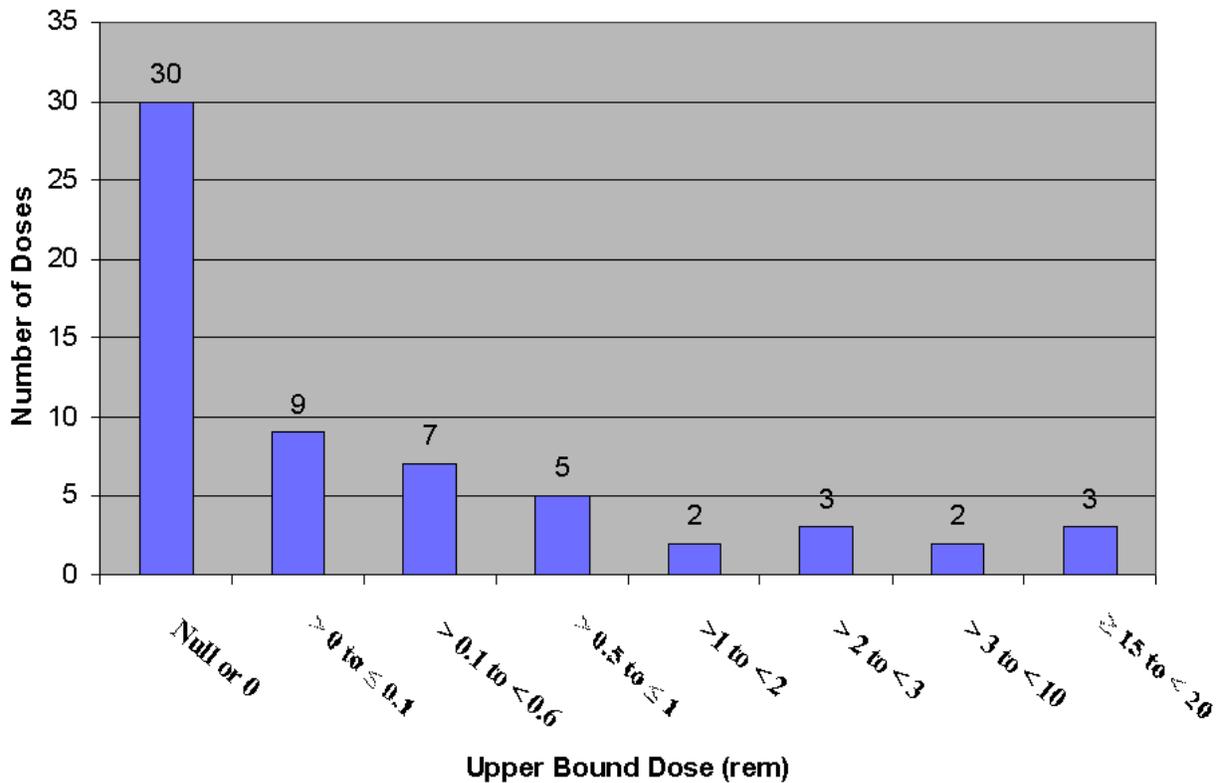
⁶ Bennett, B., Repacholi, M. and Zhanat, C. (eds.), "Health effects of the Chernobyl accident and special health care programmes." World Health Organization Press, Geneva, Switzerland, 2006, pp. 77-80.

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DISCUSSION

The Defense Threat Reduction Agency's (DTRA) Nuclear Test Personnel Review Program (NTPR) proposes to develop a screening procedure for U.S. atmospheric nuclear testing and occupation of Japan veterans with cataract claims that will enable the expedited processing of those cases falling well above or below the radiation dose threshold associated with PSC formation. As of December 2006, the NTPR backlog of VA cases requiring an RDA was approximately 600. Of these, 75 cases include claims for PSC formation due to radiation exposure. The proposed expedited process action is based on the results of radiation dose histories, scientific calculations, technical evaluations of personnel who received relatively extreme radiation doses due to unanticipated events, and over 60 dose assessments to the lens of the eye that were completed after the 2003 NRC report was released. Figure 1 presents recent reconstructed upper bound doses for the lens of the eye; the associated exposure scenarios represent U.S. atmospheric nuclear testing and the occupation of Japan.

Figure 1. Dose Assessments to Eye (Lens)
(61 claims from May 2003 to September 2006)



Due to the nature of radiation exposure associated with atmospheric testing, a potential threshold PSC formation dose could have been delivered as a whole body dose to include the lens of the eye, from adjacent skin or material contamination due to initial or resuspended fallout or as a direct eye exposure in some special activities.

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Based on actual radiation monitoring data from atmospheric nuclear testing and the results of over 60 PSC-related dose reconstructions completed after the 2003 NRC report, DTRA proposes to expedite Pacific Proving Ground (PPG) and Nevada Test Site (NTS) PSC cases. Following consideration and concurrence by the Veterans' Advisory Board on Dose Reconstruction (VBDR), NTPR will establish an expedited dose to the lens of the eye, to include corresponding external gamma and neutron whole body doses, based on actual reconstruction data (including a conservative upper bound uncertainty factor) and other technical reports relating to nuclear accidents to ensure that each veteran's reported dose will not be less than the actual dose.

NTPR will establish screening procedures for the two major theaters of atmospheric nuclear detonation, i.e., NTS and PPG. Consideration of upper bounds of potential whole body external and skin contamination doses will ensure that a veteran's reported dose is not less than his actual dose. Veterans associated with Hiroshima and Nagasaki (H&N) exclusively cannot be expedited. The recommended screening procedures are as follows:

H&N

The upper bound radiation doses associated with the H&N occupation forces are the most straightforward to define. Due to the height of detonation, the amount of fallout was minimized and areas of concern were easily identifiable and documented. In addition, all H&N doses can be maximized by utilizing the Nagasaki exposure scenario; exposure levels and areas of maximum intensity in Nagasaki were higher than at Hiroshima. Based on existing information and individual scenarios, H&N PSC cases will require a full RDA, and will not be expedited. However, if a veteran is also a participant of PPG or NTS operations, the claim will be expedited for PSC as described in the respective process summaries that follow.

NTS

NTS cases can be primarily grouped into distinct radiation exposure scenarios (applicable to potential dose attributable to cataract formation).

- Participants on the ground, including observers at various distances from a detonation, maneuver troops at a detonation, or troops engaged in various activities between detonations. These personnel could have been exposed to prompt radiation, activated soil and fallout, radionuclides that were ingested or inhaled following resuspension, or residual ambient radiation.
- Airborne personnel who may have been exposed to inhaled or ingested activity while traversing the plume and ambient radiation.
- Personnel assigned to equipment decontamination duties and other related tasks can be included in one of the above scenarios to maximize dose.

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Expedited processing that will ensure maximum benefit of the doubt to the veteran can be established for each NTS operation as follows: NTPR review of monitored and calculated external dose data for whole body and skin contamination for volunteer forward observer personnel at NTS test shots, RDAs of participants, and film badge dosimetry data for non-forward observers.

PPG

A review of PPG test shots and exposure scenarios by the NTPR staff will establish theoretical maximum doses, i.e., a separate eye dose contribution for cataracts and an external dose. PPG island-based and ship-based personnel can be primarily grouped into distinct exposure scenarios based on the residence island where a veteran was billeted, the position of a veteran's ship at the time of the detonation (and movement thereafter), a veteran's location and job on the ship or on land, and whether or not the veteran visited a potentially contaminated island or engaged in other activities that would suggest that a higher dose is possible. Factors used to establish dose include maximum shipboard exposure time during fallout, fallout intensity, assumed liberty activities (e.g., visits to contaminated islands or swimming in contaminated water) and extra duty (e.g., small boat operations to radiation-intensive areas).

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