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REVIEW OF THE DOSE RECONSTRUCTION PROGRAM OF THE DEFENSE THREAT REDUCTION AGENCY

This report examines the radiation dose reconstructions for military personnel who participated in various activities during atmospheric nuclear-weapons tests. The tests took place in New Mexico, Nevada, and the Pacific from 1945 through 1962. Other personnel included in the dose reconstructions are those who were prisoners of war in Japan or who were stationed in Hiroshima or Nagasaki, Japan, after the atomic bombings of 1945. Hundreds of thousands of personnel were involved. Most of the radiation doses were received from exposures to radioactive fallout, and not from the nuclear-weapons detonations themselves. The soldiers were mostly too far away from the shot locations to receive radiations directly from a detonation.



Photo courtesy National Archives

Dose-reconstruction efforts began in the late 1970s, and a compensation program for atomic veterans whose diseases might have been caused by radiation exposure began in the early 1980s. The Defense Threat Reduction Agency (DTRA) is the Department of Defense agency responsible for assessing radiation exposures of atomic veterans. Science Applications International Corporation (SAIC) has performed the dose reconstructions under a contract from DTRA. SAIC works with JAYCOR, which is responsible for confirming that a veteran was a participant in the testing program and for developing information about the veteran's activities that will help in estimating a dose. The Department of Veterans Affairs (VA) is the main contact with the veteran and is ultimately responsible for determining eligibility for compensation.

After Senate hearings in April 1998, the General Accounting Office (GAO) was asked to review the reliability of the dose reconstruction program. In January 2000, GAO reported that dose reconstruction is a valid method for use in evaluating claims but noted that the program had no independent review process. In December 2000, the National Research Council formed a committee in response to a charge by Congress that directed it to evaluate randomly sampled dose reconstructions and address these four issues:

- Whether or not the reconstruction of the sample doses is accurate.
- Whether or not the reconstructed doses are accurately reported.
- Whether or not the assumptions made regarding radiation exposure based on the sampled doses are credible.
- Whether or not the data from nuclear tests used by DTRA as part of the reconstruction of the sampled doses are accurate.

The committee was also asked to recommend whether there should be a permanent system of review for the dose reconstruction program.

A number of laws and regulations apply to the dose reconstruction program. In particular, under 38 *CFR* 3.309, veterans who are confirmed participants and have any of 21 cancers are eligible for compensation regardless of their radiation exposures; this is often called the presumptive regulation. The list of cancers considered “presumptive” has been added to over the years. A different regulation, 38 *CFR* 3.311, applies to other diseases; this is the “nonpresumptive” regulation. For them, a dose assessment is used to help evaluate whether a veteran’s disease is more likely than not to have been caused by radiation exposure during atomic testing. Furthermore, the veteran is to be given the benefit of the doubt in evaluating a claim for a nonpresumptive disease if his participation cannot be definitely confirmed. He is also to be given the benefit of the doubt in estimating his dose.

Dose reconstruction involves estimating the most likely dose that a veteran received and also a higher number called an upper-bound dose, which is the dose to be considered in deciding compensation. For skin, eye, and inhalation exposures, only an upper bound is estimated. A stated goal of the dose reconstruction program is that there not be more than a 5% chance that the reported upper bound is lower than the actual dose the veteran received.

Radiation dose reconstruction can be tedious and complicated. Often historical information is lacking about individual activities that would help in estimating a dose. The committee recognized the difficulties that would face any agency or organization that took on this challenge. In addition, the science involved in dose reconstruction has changed in the last 25 years. For all those reasons, independent review of the process is important.

On the basis of its review of 99 individual dose reconstructions and other program documents, the committee reached these conclusions:

1. Although the methods used to estimate *average* doses to participants in various units are generally valid, many participants did not wear film badges all the times that they might have been exposed, so *individual* doses are often highly uncertain.
2. Upper bounds of doses from external exposure to gamma radiation are often underestimated because of questionable assumptions about a person’s locations and duration of exposure.
3. Upper bounds of doses from external exposure to neutrons are always underestimated by a factor of about 3-5, but few participants received much neutron exposure.
4. Skin and eye doses from exposure to beta particles do not always seem to be credible upper bounds, and skin doses from radioactive particles on the skin do not seem to have been taken into account.
5. Methods used to estimate doses due to inhaled radioactive materials involve many assumptions that are subject to error because of a lack of data to monitor exposures. Nonetheless, in some exposure scenarios, estimates of inhalation dose appear to be credible upper bounds. In other cases the estimates are too low, but credible upper bounds would still be small doses. However, there were scenarios involving some maneuver troops and close-in observers at the Nevada Test Site in which upper bounds of inhalation dose were underestimated by large factors, and the doses in these cases often could be important. Large underestimates of inhalation dose were due mainly

to neglecting the effects of the blast wave produced in a detonation, which could have caused resuspension of large amounts of radionuclides that had accumulated on the ground from previous tests.

6. Dose reconstruction has not routinely included exposure from ingestion of radioactive materials or contaminated food, but the committee does not believe this was an important source of radiation exposure for most participants.
7. In developing exposure scenarios and assessing film-badge data, veterans are not always given the benefit of the doubt and often were not contacted to verify their activities, so underestimates could have occurred in individual cases. The veterans themselves are a valuable resource that has been underused.
8. Because of problems of scenario development and estimation of external and internal doses, total doses do not always provide credible upper bounds, and the resulting underestimates often are substantial. Methods used to estimate doses and their uncertainties should be re-evaluated, and the requirement to give the veteran the benefit of the doubt should be applied more consistently in dose reconstructions.
9. Interaction and communication with the atomic veterans should be improved. For example, veterans should be allowed to review the scenario assumptions used in their dose reconstructions before the dose assessments are sent to the Department of Veterans Affairs for claim adjudication.
10. Dose reconstructions have been accurately reported to veterans, but uncertainty should also be reported and carefully explained to VA and the veterans. Also, since some changes in the dose reconstruction program could have made a substantial difference in some earlier dose estimates, veterans and their advisors should be advised when changes are made and that they can ask for updated dose assessments and re-evaluation of their prior claims.
11. More effective approaches should be established to communicate the meaning of doses to veterans in terms of their risk of disease and the probability that their disease was caused by radiation exposure from atomic testing.
12. A comprehensive manual of standard operating procedures for the conduct of dose reconstructions is needed. The lack of a procedures manual may have led to inconsistencies in dose reconstructions.
13. There was little evidence of quality control in dose reconstructions the committee reviewed. For example, many calculations are illegible or not explained. A comprehensive program of quality assurance and quality control of dose reconstructions is needed.
14. If the dose reconstruction program continues, the committee believes there should be an independent oversight system. For example, an advisory board could be established to include experts in the various parts of the program and at least one atomic veteran. Broad oversight would be desirable, including the roles of both DTRA and VA. The board should be able to conduct random audits, review methods and recommend changes, and meet with atomic veterans regularly and help DTRA and VA communicate with them.

About 70% of all dose reconstructions have been done in response to veterans' claims for compensation, but many of their diseases are now included in the presumptive category. Except for beta exposures and skin cancer, it appears to the committee that most future claims for nonpresumptive diseases would not qualify for compensation, even with revised upper-bound dose estimates.

The committee appreciates the sacrifices made by the veterans in the service of their country and their frustrations in dealing with the bureaucracy to obtain the compensation that they believe they are entitled to. Perhaps a few more veterans who filed claims in the past would have been compensated if the upper-bound dose estimates had been more credible. It is evident that only a very small number of awards have been granted for claims under the nonpresumptive regulation out of many thousand that have been filed. The exact number of successful claims is difficult to determine but the committee has concluded that the number is probably on the order of 50, as has been previously reported. Obviously it is very unlikely that a claim will be granted when a veteran files under the nonpresumptive regulation.

Yet there are good reasons for the low rate of successful claims for nonpresumptive diseases. There is an extensive amount of information from radiation studies in humans which indicates that ionizing radiation is not a potent cause of cancer. Thus, although the committee believes that in many cases the veterans have legitimate complaints about their dose reconstructions, veterans also need to understand that in most cases their radiation exposure probably did not cause their cancer. Even if reasonable changes are made in the dose reconstruction program, it is not likely that the chance of a successful claim will increase very much when a dose reconstruction is needed, except possibly in cases of skin cancer.

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