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# Chapter 1

## Introduction

***Contents:** This chapter provides an introduction to the full report. It includes a discussion of why this project was undertaken, what is included in the project, and what is beyond the scope of this effort. The organization of this report is briefly described.*

### 1.1 Background

In 1998, Congress provided funding for the Department of Health and Human Services (DHHS) to study the health impact on American peoples of radioactive fallout. More specifically, the Committee on Appropriations of the United States Senate reported the following (U.S. Senate 1998):

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“The Committee has allocated \$1,850,000 with the emergency fund for a study of the health consequences to the American population of nuclear weapons tests conducted by the United States and other nations. The Committee expects the Centers for Disease Control and Prevention to be the lead agency on the study, with the support of the National Cancer Institute. The Department should conduct an initial assessment of the feasibility and public health implications of such a study. The assessment ought to address major issues such as: radiation dose estimation and risk assessment, appropriate epidemiologic investigations, and health communication strategies for promoting better understanding of the research by the general public. In developing the assessment, design, and conduct of the study, the Department is expected to include input from the public and the Advisory Committee on Energy-Related Epidemiologic Research. In conducting the study, the Department ought to give high priority to examining the health consequences of exposure among both the general and high-risk populations to the full range of radionuclides produced by a nuclear weapons test. The Committee expects to be informed of the study’s progress on a regular basis and expects to receive a final report by July 1, 2000.”

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This action by Congress followed the release of the National Cancer Institute's (NCI) report *Estimated Exposures and Thyroid Doses Received by the American People from Iodine-131 in Fallout Following Nevada Atmospheric Nuclear Bomb Tests* (NCI 1997). This report provided county-level estimates of the potential radiation doses to the thyroid for American citizens resulting from atmospheric nuclear weapons testing at the Nevada Test Site (NTS) in the 1950s and 1960s. A summary of the NCI report is presented in Appendix B. DHHS' Advisory Committee for Energy-Related Epidemiologic Research (ACERER) subsequently recommended that DHHS "(c)omplete a comprehensive dose reconstruction project for NTS fallout" (ACERER 1998). (The charter for ACERER has since expired and the committee no longer exists.) In a review of the NCI report performed at the request of DHHS, the Institute of Medicine (IOM) concluded that additional research to estimate the total radiation exposure resulting from the deposition of all radionuclides released as a result of nuclear weapons testing would be of limited public health value (IOM 1999). The IOM acknowledged, however, that the public might desire such an effort to obtain a more complete accounting of the potential health impact of nuclear weapons testing on American populations.

This report presents the technical results of an initial assessment of the feasibility and public health implications of a detailed study of the health consequences of nuclear weapons testing. In developing all aspects of the study, the Centers for Disease Control and Prevention (CDC) and NCI have actively solicited input from the public and from ACERER. Both written and oral progress reports were made to ACERER and Congressional staff members during the course of the project. Copies of the written progress reports were available for public review, and written and oral comments were received. Appendix C includes a summary of some of these activities. In addition, the final draft report was peer reviewed by the National Academy of Sciences' Committee on Assessment of CDC Radiation Studies (NAS/NRC 2003).

## **1.2 Scope of work**

### **1.2.1 Feasibility study**

CDC and NCI were not asked to complete an extensive study of the health consequences to American people of nuclear weapons tests conducted by the United States and other nations, but rather to assess feasibility only. Hence, instead of developing new tools or gathering all possible data and information that is necessary to perform an extensive, detailed study of this type, a review of previous studies supplemented with extensive but rudimentary calculations was used to evaluate the feasibility of a detailed study. The information that is readily available on the doses from radioactive fallout from nuclear weapons tests includes: (1) the NCI (1997) report related to the thyroid doses from <sup>131</sup>I produced by atmospheric nuclear weapons tests conducted at the NTS; (2) several publications related to the estimation of doses received by the populations who lived in proximity of the NTS (e.g., Church et al. 1990); and (3) miscellaneous pieces of information related to global fallout due mainly to atmospheric nuclear weapons tests conducted on islands in the Pacific Ocean and in the former Union of Soviet Socialist Republics (U.S.S.R.). The United Nations Scientific Committee on the Effects of Atomic Radiation

(UNSCEAR) has analyzed some of this information in order to derive average doses over the population of northern and southern hemispheres (e.g., UNSCEAR 2000).

In this feasibility report, estimates are provided of the radiation doses received by American people in the contiguous 48 states as a result of the atmospheric nuclear weapons tests conducted by the United States, the former U.S.S.R., and the United Kingdom (U.K.). Only above-ground nuclear weapons tests conducted from 1951 through 1962 are considered in this report. Atmospheric nuclear explosions conducted by France and China, as well as underground nuclear explosions from any nation, are not considered in this feasibility report, as it is generally acknowledged that the most important contributions to the radiation exposures arose from atmospheric nuclear tests conducted by the United States, U.K., and the former U.S.S.R during the pre-1962 time period.

Doses due to external exposure from radionuclides deposited on the ground and internal exposures from ingestion of contaminated foods are estimated for each county of the contiguous states for the most sensitive organs and tissues. These dose estimates are based on an initial review of the open literature, and they are not derived from sophisticated computer programs that could be designed for that purpose. They are, however, a significant extension of previously reported dose estimates, especially for fallout from non-NTS 'global' sources. Ingestion dose estimates are provided for 19 different radionuclides for fallout from NTS. Based upon the screening calculations performed for previous fallout studies, these radionuclides account for at least 95% of the dose through ingestion of contaminated foods to each organ (Ng et al. 1990). Two additional radionuclides,  $^3\text{H}$  and  $^{14}\text{C}$ , are considered for global fallout. Doses due to inhalation of radionuclides were not considered in this initial feasibility report, but they have generally been found to be much smaller than those due to ingestion.

The estimated doses that are presented for NTS and global fallout are significantly different with regard to their precision and reliability. Doses from NTS are based on a large database and a significant amount of previous work in the area of dose estimation. Approximate estimates of the uncertainty associated with these dose estimates are provided. Estimates of doses from global fallout, however, are based on a much more limited database and on previous dose estimates that have been averaged over large geographic areas. The dose estimates presented here for any particular county are probably quite imprecise, and the exposure rate probably varied significantly from place to place within a county. Not enough data were available to allow for the quantification of the uncertainty associated with the doses from global fallout.

In addition to providing rudimentary estimates of dose, this report also addresses the feasibility of utilizing these doses and other information in a risk analysis to characterize the effects of global fallout on the health of people in the United States. As a simple example to demonstrate the feasibility of estimating lifetime cancer risk due to exposure to radioactive fallout, estimates of the average lifetime risk of developing all cancers, leukemia, and thyroid cancer are presented for the United States population. This report also presents a brief review of ongoing epidemiologic studies being conducted in the United States and elsewhere. Finally, the report provides the outline of the strategy and issues that could be

considered in developing a comprehensive health communication plan for affected citizens if a detailed study is undertaken.

## **1.2.2 Public health implications**

An important aspect of this project is consideration of the public health implications of a detailed study. CDC and NCI acknowledge that some people desire that the most detailed dose and risk assessment possible be done so they will know more about their radiation exposure from nuclear weapons fallout. Also, additional studies may contribute to our scientific knowledge of the health effects of ionizing radiation. The question that should also be addressed is whether or not an appropriate public health intervention will result from performing such studies. The answer to that question is complex and must be evaluated in terms of public interest, the Government's commitment to closure of 'fallout' related issues, and the severity of the risk from fallout compared to other hazards in today's environment which might be remedied by use of the same funding.

Also, CDC and NCI generally understand public health as "(t)he science and art of preventing disease, prolonging life, and promoting health through organized efforts of society" (Acheson Report 1988). Dose and risk analyses can help in the identification of the likelihood of diseases that in turn can potentially be treated or prevented. The very rudimentary results presented in this report suggest that science is unlikely to provide a public health impetus for conducting more detailed fallout-related studies. However, given the history of secrecy associated with the development and testing of nuclear weapons and documented and intentional radioactive releases as well as human radiation experiments, the Federal Government must be sensitive to the views of some Americans about the United States, global weapons programs, and the Government's responsibilities. This legacy of mistrust has developed over the past half-century, and it presents a formidable social and political context within which to perform studies and communicate results. Resolution of these issues would require assistance from agencies other than CDC and NCI.

## **1.3 Issues outside the scope of this report**

One issue related to examining the health consequences resulting from nuclear weapons tests is that of medical screening of individuals for potential radiogenic diseases. In their review of the NCI report on NTS thyroid doses, the IOM recommended against a program to systematically screen either the American population in general or any population subgroup for thyroid cancer (IOM 1999). However, ACERER has recommended that DHHS "(f)urther evaluate screening opportunities for thyroid cancer...[and] to evaluate the advisability and feasibility of screening for other (noncancerous) thyroid and parathyroid diseases, with a priority to evaluate this service for those at highest risk due to their exposures" (ACERER 1998). CDC and NCI are continuing dialogue with stakeholders on the issue of thyroid screening. As a result of any future work related to studying the potential public health impact on American populations of nuclear weapons testing, there may be other potentially radiogenic diseases where discussion of screening is appropriate.

American people living around nuclear weapons development and production sites may have been exposed to radionuclides released from these sites as well as to radionuclides in weapons testing fallout. Extensive dose reconstruction and risk assessment activities have been completed for some of these sites, e.g., the former Feed Materials Production Center near Fernald, Ohio, and similar activities are underway at other sites, e.g., the Savannah River Site near Aiken, South Carolina. There are still other sites where no such activities are underway or planned for the future, e.g., the Gaseous Diffusion Plant at Portsmouth, Ohio. Another group for which attempts have been made to reconstruct doses is military personnel exposed during nuclear weapons tests (NRC 1985). Some stakeholders have suggested that a method should be developed to add up doses from these multiple exposures for affected individuals. A discussion of the technical and communication issues associated with such a program of adding doses is beyond the scope of this report.

The doses estimated in this report that arise from the ingestion of contaminated food depend greatly on the values chosen for the amount of different foods that are eaten by people. The values of food intake used in this feasibility report are based on averages developed for a previous assessment of NTS doses (Breshears et al. 1989). These values may not be appropriate for all people in the United States, including members of Native American tribes. A more detailed breakdown of food consumption, however, is beyond the scope of this project.

## **1.4 Organization of this report**

This feasibility report continues with discussion of how, when, and where radionuclide fallout was created during the testing of nuclear weapons in the atmosphere (Chapter 2). Rudimentary county-level dose estimates are provided for people living in the 48 contiguous states for a number of radionuclides of potential biologic significance from both NTS and global fallout (Chapter 3). Next, a brief literature overview of the potential effects of radiation on the health of people is presented, including a discussion of epidemiologic investigations (Chapter 4). In this same chapter, dose estimates are used to estimate the average risk to the American population of developing all cancers, leukemia, and thyroid cancer from fallout to demonstrate the feasibility of estimating risk for selected health outcomes. Next, a discussion of the issues that must be addressed if a plan is to be developed to communicate the results of a detailed study to the American public is presented (Chapter 5). Finally, the overall results of this study are summarized and options that might be considered for further activities are presented (Chapter 6). Many technical terms are used in the body of this report. These terms are defined when they are first used. To assist the reader further, a Glossary of terms is provided following Chapter 6. A number of appendices provide additional technical details for some of the material presented in the main body of the report.

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