

A Technical Review of the Final Report of the Hanford Thyroid Disease Study

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A. James Rутtenber, Ph.D., M.D.
F. Owen Hoffman, Ph.D.
Raymond J. Carroll, Ph.D.
Duncan C. Thomas, Ph.D.
Sander Greenland, M.A., M.S., Dr.P.H., C. Stat

Summary of Findings

We conclude that the results and conclusions of the Final Report of the Hanford Thyroid Disease Study (HTDS) (Davis et al., 2002) cannot be used to rule out important risks for thyroid cancer, neoplasms, or hypothyroidism from exposures to iodine-131 (I-131) from the Hanford nuclear facility. Specifically, we find that:

- (1) The interval estimates given by HTDS are much too narrow because they ignore large sources of uncertainty; in particular:
 - (a) They ignore major sources of uncertainty in dose assignment, and
 - (b) They do not account for the large losses from the cohort (the 1/3 for whom clinical outcome data were unavailable); and
- (2) The HTDS has misinterpreted its own statistics by relying on statistical significance, and then, on top of that, not calculating or interpreting significance test results correctly:
 - (a) They miscalculate significance levels by making inappropriate Bonferroni adjustments,
 - (b) They misinterpret nonsignificance as lack of evidence of a dose response, when in fact there is a trend in dose-response in some analyses, and
 - (c) They do not take adequate account of their own confidence intervals in formulating their closing statements.

Proper accounting for these problems would reveal that the study does not provide evidence capable of discriminating between no effect and relatively strong effects.

Introduction

In this report, we address the extent to which the HTDS results and interpretations can be used to assess disease causation for individuals exposed to Iodine-131 (I-131) from the Hanford nuclear facility. We focus on three important questions: 1) Were radiation doses to the thyroid and their uncertainties modeled appropriately for the dose-response analyses that were conducted?; 2) Did the study, as conducted and analyzed, have adequate power to detect any likely effects at the chosen (0.05) significance level, as the HTDS authors assert?; and 3) Given the problems with estimates of doses and their uncertainties, and with the consequent low statistical power, were the analytic approaches and interpretations of results adequate and appropriate?

As detailed below, the answers to these questions are: "No," "No," and "No." For (1), we identify a number of problems with the dose estimates made for individual subjects, and substantial unmodeled sources of uncertainty in the radiation dose estimates. For (2), we point out that the statistical power for the study has been mischaracterized and is likely to be far lower than claimed by the HTDS. For (3), we identify problems with

