

NRC Research and Technical Assistance Report

INTERIM REPORT



ACCESSION NO.
ORNL/HASRD-126

Contract Program or Project Title: Statistical Analysis of Dose Estimates Via Food Pathways for Radionuclides Released from Nuclear Power Reactors

Subject of this Document: Technical Progress

Type of Document: Monthly Progress Report

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Date of Document: April 1981

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Prepared for
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
Under Interagency Agreement(s) DOE #40-544-75
NRC FIN No. B0748

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for the
Department of Energy

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NRC Research and Technical Assistance Report

MONTHLY PROGRESS REPORT FOR APRIL 1981

STATISTICAL ANALYSIS OF DOSE ESTIMATES VIA FOOD PATHWAYS
FOR RADIONUCLIDES RELEASED FROM NUCLEAR POWER REACTORS
(189 No. B-0748)

PRINCIPAL SCIENTISTS: F. O. Hoffman

Objectives:

The objective of this technical support project is to determine the statistical distribution in dose estimates to critical organs from important radionuclides using the models and model parameters that are contained in Regulatory Guide 1.109.

Major Accomplishments:

Evaluation of the Sr-90 Dose Factor

The Sr-90 dose conversion factor of Regulatory Guide 1.109 is largely based on the calculational approach of ICRP Publication 2 (1959). At that time the guidance for bone seekers was based on a direct comparison of the energy deposit of the nuclide of interest with that of Ra-226 (0.1 μg Ra-226 body burden). For non-radium nuclides emitting particulate radiation, an additional modifying factor of 5 was included in the comparison.

A large body of information has been compiled on bone seekers since the issuance of ICRP-2 (1959) including:

- (1) detailed modeling of the metabolism of alkaline earth elements (ICRP 72), and
- (2) elucidation of the skeletal tissues at risk (ICRP 67).

These ICRP reports, as well as a host of research efforts reported in the open literature, clearly indicate that today we have a much more complete understanding of both the metabolism of strontium and skeletal tissues at risk.

In this context then it is inappropriate to pursue a qualification of the uncertainties in the ICRP-2 dosimetric model for Sr-90. As was known at the time of its formulation, the parameters describing the metabolism of strontium in the body used in the development of the MPC's were biased — in the conservative direction. This level of conservatism was necessary at that time to make effective use of vast Ra-226 experience in man, however, in face of little experience with other bone seekers. In the intervening years much research was undertaken to provide the basic insight into the dosimetry of bone seekers. An appropriate action plan for the purposes of this project appears to include:

- (1) consideration of the dose factor for the skeletal tissues at risk -- namely, endosteal cells and active marrow, and
- (2) quantify the present uncertainty in these factors.

The relation of the new information to that contained in Regulatory Guide 1.109 or its source document NUREG-0172 would be presented where possible. However, comparison of dose factors for "bone" as defined in NUREG-0172 and those for endosteal cells and active marrow are clearly not applicable.

189 Revisions

The need to revise the 189 No. B-0748 was brought to the attention of the principal investigator by the project manager at NRC. Revisions were incorporated into the 189 on April 27, 1981, to reflect a reduced level of funding in FY 1982 and a reduced projected rate of spending. Currently, the project is without funds pending receipt of the remaining \$30,000 of the \$60,000 allocated for the project.

Monte Carlo Computer Program

A Monte Carlo computer program developed to analyze uncertainties for radioiodine ingested via milk, beef, leafy vegetables, and non-leafy vegetables is currently being adapted for analysis of ⁹⁰Sr and ¹³⁷Cs. The program is a modification of the model referred to by O'Neill et al. (*Health Physics* 40:760-764, 1981).

Status of Project:

Remaining funds for completion of the project are needed. Work is in progress on determination of uncertainties associated with ⁹⁰Sr dose conversion factors for endosteal cells and active bone marrow. Proposed outline for final report is being revised.

Manpower and Cost Summary:

<u>Efforts in Man Months</u>			<u>Cost K\$</u>			<u>Remaining funds to completion (est.)</u>
<u>Apr. 1981</u>	<u>FY 1981</u>	<u>Total to date</u>	<u>Apr. 1981</u>	<u>FY 1981</u>	<u>Total cost to date</u>	
0.5	8.0	1.9	5	50	30	\$30,000

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