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MEMORANDUM FOR: Harold R. Denton, Director  
Office of Nuclear Reactor Regulation

FROM: Saul Levine, Director  
Office of Nuclear Regulatory Research

SUBJECT: RESEARCH INFORMATION LETTER # 35 SFACTOR: A COMPUTER  
CODE FOR CALCULATING DOSE EQUIVALENT TO A TARGET ORGAN  
PER MICROCURIE - DAY RESIDENCE OF A RADIONUCLIDE IN A  
SOURCE ORGAN

This memorandum transmits the SFACTOR code<sup>1/</sup> for calculating S, the average dose equivalent to each of a specified list of target organs (anatomical areas being irradiated) per microcurie-day residence of a radionuclide in source organs (anatomical areas containing concentrations of the radionuclides) in man. This work was performed by the Health and Safety Research Division of the Oak Ridge National Laboratory under the direction of the Environmental Effects Research Branch of RES.

Research Request NRR-78-5, "Confirmatory Research Programs in Radiation Dose Estimation," stated that NRR staff estimations of radiation exposure to man required a broadly applicable, documented, state-of-the-art dose estimation methodology. As part of its comprehensive development of computer codes for calculating internal doses resulting from incorporation of radionuclides, ORNL has developed the SFACTOR code. This code computes the S-factors to be used as input for the INREM II code which computes the dose equivalent to specified target organs.

The SFACTOR methodology is largely based on the work of W. Snyder et al.<sup>2/</sup> It has been expanded to include components of S from alpha and spontaneous fission decay, in addition to electron and photon radiations. The S-factors are calculated for an adult with characteristics similar to those of the International Commission on Radiological Protection's "reference man."

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<sup>1/</sup>SFACTOR: A Computer Code for Calculating Dose Equivalent to a Target Organ per Microcurie-Day Residence of a Radionuclide in a Source Organ, ORNL/NUREG/TM-85.

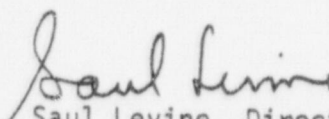
<sup>2/</sup>A Tabulation of Dose Equivalent per Microcurie-Day for Source and Target Organs of an Adult for Various Radionuclides, ORNL-5000.

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The technique for calculating absorbed fractions, embodied in the S-factor methodology, has been verified experimentally<sup>3/</sup>. A phantom, a physical representation of a human, containing simulated skeletal components, lungs, and soft-tissue areas, was constructed. Photon emitters were distributed uniformly in selected organs of the phantom, and the absorbed fractions were measured.

The ORNL report contains a complete listing of the SFACTOR computer code written in the PL/I language with extensive commentary. A typical job control language sequence for executing the program on the IBM 360 is given as an example to the user. Sample computer output for 52 radionuclides is presented for an array of 24 target organs and 22 source organs.

We recommend that the SFACTOR code presented in ORNL/NUREG/TM-85 be used by your staff in calculating annual doses to man from routine releases of reactor effluents. If you have any questions with regard to this report, please contact Dr. Judith D. Foulke (427-4358).



Saul Levine, Director  
Office of Nuclear Regulatory Research

Enclosure: ORNL/NUREG/TM-85

<sup>3/</sup> Measurement of Absorbed Fractions for Photon Sources Distributed Uniformly in Various Organs of a Heterogeneous Phantom, ORNL-TM-4411.