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Prepared for  
 U. s. Nuclear Regulatory Commission  
 Washington, D. C. 20555  
 Under Interagency Agreement DOE #40-550-75  
 NRC FIN No. B0188

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 Department of Energy

QUARTERLY PROGRESS REPORT

INTERIM REPORT

NRC Research and Technical Assistance Report

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QUARTERLY PROGRESS REPORT  
FOR JULY-SEPTEMBER, 1980

DOSIMETRY AND BIOTRANSPORT MODELS TO IMPLEMENT ALARA  
(FIN/189A No. B0188)

Health and Safety Research Division  
Oak Ridge National Laboratory

PRINCIPAL SCIENTISTS: D. C. Kocher and G. G. Killough

OBJECTIVE:

To implement current dosimetry and environmental transport models and associated data bases to calculate realistic estimates of radiation doses to the general public, with the view of meeting particular needs of the NRC as the Commission develops capabilities to implement dose limits which satisfy the requirement "as low as reasonably achievable" (ALARA).

PROGRESS IN JULY-SEPTEMBER, 1980:

Task 1a. Decay data and dosimetry models (D. E. Dunning, Jr., and G. G. Killough)

The paper, "A Comparison of Effective Dose Equivalents from Three Major Internal Dose Compilations," by D. E. Dunning, Jr., and G. G. Killough has been accepted for publication in *Radiation Protection Dosimetry*.

A draft of the report, *Estimates of Internal Dose Equivalent to 22 Target Organs for Radionuclides Occurring in Routine Releases from Nuclear Fuel-Cycle Facilities, Vol. III*, by D. E. Dunning, Jr., G. G. Killough, S. R. Bernard, J. C. Pleasant, and P. J. Walsh, has been prepared and is undergoing internal review at ORNL. This volume, to be published as NUREG/CR-0150 Vol. 3, ORNL/NUREG/TM-190/V3, provides an updated summary of estimates of committed dose equivalent for 142 radionuclides considered in the two previous volumes, and several additional noble gas radioisotopes are also considered. A separate tabulation of effective dose equivalent is provided for all 142 radionuclides; this quantity, as defined by ICRP Publication 26, provides an indication of the overall health risk resulting from exposure to a radionuclide.

Task 1b. Preparation of supplementary report on DOSFACTOR computer code (D.C. Kocher)

Revision of the DOSFACTOR computer code incorporating improved organ dose-rate factors for external exposure to photons and calculation of electron dose-rate factors for skin has been completed. Preparation of a Laboratory report documenting the revised code has begun. The manuscript, "Electron Dose-Rate Conversion Factors for External Exposure of the Skin," by D. C. Kocher and K. F. Eckerman has been accepted for publication by *Health Physics* journal.

Task 1d. Testing and documentation of radiation dosimetry information system (M. T. Ryan, D. E. Fields, and D. E. Dunning, Jr.)

Generation of the metabolic model and S-factor data files for the interactive computer code PREREM has been completed. Extensive testing of the dosimetry information system has continued. A Laboratory report documenting the PREREM code and associated data files and serving as a guide to users is in preparation.

Task 2a. Parameter sensitivity and error analysis of model for vegetable pathway (L. M. McDowell-Boyer, J. C. Pleasant, and G. G. Killough)

The RAGTIME computer code was modified to facilitate sensitivity testing of parameters associated with the crop pathway described by RAGTIME. A series of test cases have been set up by which the effects of independent variation in values or mathematical formulations of such parameters on computed results can be observed.

Task 2b. Design, implementation, and documentation of model for beef pathway (L. M. McDowell-Boyer, J. C. Pleasant, and G. G. Killough)

A submodel describing age- and season-dependent grain, forage, and hay ingestion rates by cattle was implemented during the last quarter, thus improving the time-dependent capabilities provided by RAGTIME. Additionally, literature was reviewed and values were tabulated regarding seasonal aspects of pasture growth such that a time-dependent submodel for interception of aerially-depositing radionuclides may be implemented. The latter submodel will also have applications in the dairy pathway.

A manuscript entitled, "Dynamic Modeling of Radionuclides in Agricultural Food Chains," was prepared by L. M. McDowell-Boyer, G. G. Killough, and J. C. Pleasant during this quarter and submitted to *Nuclear Technology* journal. The paper emphasizes the utility of the RAGTIME model in testing food-chain model sensitivity to time-dependence.

Task 3.  $^{14}\text{C}$  and  $^3\text{H}$  collective dose (D. C. Kocher)

As a continuation of previous work on  $^{129}\text{I}$ , revisions of the model on the global iodine cycle have been completed. The draft manuscript, "A Dynamic Model of the Global Iodine Cycle and Estimation of Dose to the World Population from Releases of Iodine-129 to the Environment," to be submitted to *Environment International*, has completed internal technical review.

BUDGET AND TECHNICAL MANPOWER EXPENDITURES (FY 1980):

| <u>Reporting Period</u>   | <u>Project Costs, \$</u> | <u>Technical Support,<br/>Man-months</u> |
|---------------------------|--------------------------|--|
| FY-1980                   | 142,160                  | 24.6                                     |
| Total to Date             | 142,160                  | 24.6                                     |
| Estimated Cost<br>FY-1980 | 142,000                  |  |

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