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Prepared for
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

NRC FIN No. B2271

NRC Research and Technical
Assistance Report

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INTERIM REPORT

QUARTERLY REPORT, APRIL 1980 TO JUNE 1980

MATHEMATICAL SIMULATION OF SEDIMENT AND
CONTAMINANT TRANSPORT IN SURFACE WATERS

FIN Number B2271

Prepared for the
U.S. Nuclear Regulatory Commission

Pacific Northwest Laboratory
Richland, Washington 99352

NRC Research and Technical
Assistance Report

TASK B. TRANSPORT OF SEDIMENT AND RADIONUCLIDES IN OCEANS

During the third quarter of FY-1980, efforts in Task B focused on procurement of sediment and radionuclide data for the Irish Sea from the Fisheries Radiobiological Laboratory (FRL). It was expected that Mr. William Templeton, a PNL staff member who formerly worked with several of the staff members of FRL, would meet with Dr. R. J. Pentreath at a conference in mid-July. It was our hope that discussion between the two would effect the cooperation of FRL in our data collection efforts. Unfortunately, neither Dr. Pentreath nor anyone else from FRL was at the conference. Upon his return, Mr. Templeton called FRL in our behalf; he learned that all four senior staff members had recently left for about a month. It is hoped that NRC efforts to secure the assistance of FRL will be successful.

A copy of the most recent letter from FRL is attached. The letter did not arrive until July 30 because it was sent by surface mail.

Work is progressing on the hydrodynamic modeling of the Irish Sea. The grid has been set up and the input data prepared. Changes are being made to the hydrodynamic code to allow for a variable wind input. The model being used in the two-dimensional finite element code CAFE-1 (Wang and Connor 1975). This code solves the vertically integrated momentum and continuity equation to obtain time and spatially varying values for water discharge and depth.

To operate the CAFE-1 code, data is required to adequately specify hydrodynamics boundary conditions as well as initial conditions. In addition, it is desirable to have additional data to allow verification that the code is operating properly. The required boundary condition data include:

- Water discharges on the water boundaries as well as river discharges on the land boundaries
- Change in the surface elevation of the boundary nodes due to the tides
- Bathymetry of the simulation region
- Wind data.

Initial condition data include:

- Surface elevations for all nodes
- Water discharges at all nodes.

In addition, it is desirable to have data on the time varying surface elevations and water discharges at points within the boundaries. This data would allow calibration of the code and verification that the code is predicting reasonably well.

Pending the outcome of NRC's efforts, we are testing the model using predicted tide data and arbitrarily selected wind velocity data. Bathymetry data was obtained from charts of the region. When a simulation period is selected based upon the availability of sediment and radionuclide data, the hydrodynamic model will be run using tide, wind, and wave data collected during that period.

TASK C. TRANSPORT OF SEDIMENT AND RADIONUCLIDES IN ESTUARIES

During the third quarter of FY-1980, work continued on the development of a three-dimensional sediment and radionuclide transport model for estuaries. As part of the modification of FETRA to allow for three-dimensional calculations of sediment and radionuclide distributions, changes were made in the storage of variables and the manipulation of matrices, resulting in decreased computation time.

The Department of Energy granted permission for use of the Battelle VAX computer for this project, as shown in the attached letter received on June 18, 1980. The hydrodynamic portion of the transport model has been installed on the VAX computer; work is progressing on the sediment-radionuclide portion of the model, which is now also on the VAX system. It is expected that the many unique interactive capabilities of the VAX will significantly aid our model development efforts.



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Our ref: FLR 4475

18 June 1980

Dear Dr Thompson

Thank you for your detailed and very explicit letter of 5 June which I have now had a chance to study at some length.


As regards the summary list of requirements on page 3:

- 1) These are known of course but will be of little value unless the related data exist.
- 2) Data exist for each station sampled but are not always complete. That is the same set of nuclides may not have been detected - in some cases because they were not detectable and the extent of particulate data also depends on circumstances.
- 3) Data are far from complete. We have determined size fractions only on selected samples by no means every station and rarely, if at all, on suspended material.
- 4) Isn't this the same as 3?
- 5) We have determined K_d values and have published them in various papers etc.

On further examination of your problem it is apparent that our respective approaches are quite different. Our work to which you refer was simply not designed to facilitate the kind of text you are envisaging and for that reason alone it is not surprising that it is doomed to failure. As well as the problem of copyright on the data, I conclude that it would be a time consuming task to extract all the data that we have in which you are interested. Because we do not have the time to spare (it is not as simple as being reimbursed for the time spent) but also because the data base is not sufficient to meet your needs, I am unwilling to pursue that matter further.

As regards the literature you seem to have a near-comprehensive coverage. I have not had time to check it off in detail and you may therefore like to have the enclosed copy of our publications list. More publications covering our work on caesium-134, -137 and the transuranics ~~is~~ in preparation but mainly relating to the water fraction.

Yours sincerely


N T Mitchell



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MEMORANDUM FOR: Distribution

FROM: Phillip R. Reed
Environmental Effects Research Branch
Division of Safeguards, Fuel Cycle and
Environmental Research

SUBJECT: PROGRESS REPORT ON PNL STUDIES TO DEVELOP/VALIDATE
SEDIMENT-RADIONUCLIDE TRANSPORT MODELS IN OCEAN AND
ESTUARY SYSTEMS

Enclosed for your information is the latest quarterly progress report we received from PNL for research activities from April through June, 1980 on the research program entitled "Mathematical Simulation of Sediment and Contaminant Transport in Surface Waters," Y. Onishi, principal investigator.

I am also enclosing copies of letters PNL sent to the Windscale Fuel Reprocessing facility requesting environment radiological data and information from the Irish Sea for the purpose of validating the model for oceans. The response from the Ministry of Agriculture, Fisheries and Food was not encouraging. Therefore, RES, in early October, 1980, made an informal request to the Ministry of Agriculture, Fisheries and Food for the Windscale data. We have not yet received their response.

Your comments are encouraged on the scope, technical merits and direction of this research effort.

Phillip R. Reed

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Environmental Effects Research Branch
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