

December 6, 1994

0297

MEMORANDUM TO: J. Austin, Chief
Performance Assessment and Hydrology Branch

FROM: R. B. Neel, Systems Performance Analyst
Performance Assessment and Health Physics Section

SUBJECT: FOREIGN TRIP REPORT: 5TH WORKSHOP
OF BIOMOV5 II, VIENNA, AUSTRIA

An abstract of my trip and a detailed trip report are attached. These documents contain those observations and comments on the meeting that I consider significant. I have repeated my recommendations as to why NRC should continue to participate in BIOMOV5.

Attachments: As stated

cc: J. Taylor, EDO
C. Stoiber, OIP
R. Bernero, NMSS
G. Arlotto, NMSS
R. Brady, SEC/ADM

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TRIP REPORT ABSTRACT
December 6, 1994

OFFICIAL TRAVELER:
Robert B. Neel

TRAVEL TO: BIOMOVs II
Vienna, Austria

BEGINNING ON: 10/24/94
ENDING ON: 10/28/94

OFFICE: Nuclear Material Safety & Safeguards
Performance Assessment and Hydrology Branch
Division of Waste Management

MEETING TITLE AND/OR AFFILIATION:

5th Workshop of the Biospheres Model Validation Studies, Phase II

ORGANIZED BY: Intera Information Technologies Limited, UK

SUMMARY OF MEETING RESULTS:

At this meeting, each of the six workgroups in BIOMOVs II reported progress made on their voluntary projects during the past year. However, my detailed report focuses only on those workgroups that relate directly to the progress of the Reference Biospheres workgroup, the group of most interest to the Performance Assessment and Health Physics Section, NMSS. Significant progress is outlined below.

REFERENCE BIOSPHERES WORKGROUP:

The final version of an "Interim Report on Reference Biospheres for Radioactive Waste Disposal", was published and distributed to all six workgroups in BIOMOVs II in October 1994. I have an extra copy.

Dr. John Kessler (Manager, Fuel Reliability, Storage and Disposal, Nuclear Power Division, Electric Power Research Institute) volunteered to chair a RBWG sub-committee that would develop criteria to define the critical group, a concept recommended by the ICRP and NRC for calculations of individual dose.

The next meeting of this workgroup is at Harwell, England on May 22, 1995, to determine the feasibility of the RES approach for the development of conceptual models for waste disposal sites.

COMPLEMENTARY STUDIES WORKGROUP:

The next phase of this study will employ multiple-regression techniques to determine the relative importance of model parameters on dose as calculated by computer codes developed in five different countries. Code parameters are described in terms of the features, events and processes (FEPs) developed by the Reference Biospheres Workgroup. This study expects to determine the relative importance of the FEPs to be used in new conceptual biosphere models.

DETAILED TRIP REPORT OF:

Robert B. Neel, Systems Performance Analyst
Performance Assessment & Hydrology Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards

SUBJECT: Trip report for the meeting of the 5th Workshop of BIOMOVs II held at the Vienna International Center in Vienna, Austria, October 24-28, 1994.

BACKGROUND: BIOMOVs (Biosphere Model Validation Studies) is an international cooperative effort to test (compare) models designed to quantify the long-term transfer, bioaccumulation, and consequences of releases of radionuclides and other trace substances to the surface environment. BIOMOVs was established at the specific request of the Performance Assessment Group (PAAG) of the Nuclear Energy Agency. It is administered by a Steering Committee composed of representatives from four countries: AECB, Canada; the Atomic Energy of Canada Limited; CIEMAT and ENRESA, Spain, and the Swedish Radiation Protection Institute. The funding for BIOMOVs II is currently provided by only three of the 18 or so countries that send representatives to participate in the workshops. (A list of attendees at this workshop is appended to this report). This funding is inadequate, and it is expected that the current BIOMOVs II will be dissolved in the Fall of 1996.

At this meeting, each of the six workgroups in BIOMOVs II reported progress made on their voluntary projects during the past year. However, my report focuses primarily on those workgroups that relate directly to the progress of the Reference Biospheres workgroup, the group of most interest to the Performance Assessment and Health Physics Section, NMSS. Significant progress is outlined below.

REPORT ON THE REFERENCE BIOSPHERES WORKGROUP (RBWG):

The chairman of RBWG is Fritz van Dorp from Nagra, Switzerland.

INTERIM BIOSPHERE REPORT

The final version of an "Interim Report on Reference Biospheres for Radioactive Waste Disposal" was published and distributed to all the workgroups in BIOMOVs II in October 1994. The report outlines the background aspects of BIOMOVs I that led to the current stage of development of the RB methodology in BIOMOVs II, and outlines the results to be expected from its application to the studies in BIOMOVs II. It provides a preliminary description of this RB methodology and an example of its application to a specific site: a river valley in Switzerland. The report emphasizes the need for regulators and biosphere modelers to discuss how to minimize the uncertainty that accompanies the translation of regulations (dose or risk) into practical assessment criteria for the biosphere. As I indicated in my trip report for the June 1993 meeting of BIOMOVs II, when completed the methodology is expected to be useful to determine to what extent further development of the biosphere models may be desirable.

CRITICAL GROUP

Several reasons why this concept is currently of importance to the NRC are:

- (1) If the proposed rule "Radiological Criteria for Decommissioning," 59 FR 43200, were adopted by the Commission, dose to the average member of a critical group would be required,
- (2) The future rulemaking for the High-Level Waste Disposal site at Yucca Mountain, NV by the Environmental Protection Agency could be based upon this concept, and finally,
- (3) This concept has already been explicitly endorsed as one approach to the calculation of public doses in Regulatory Guide 8.37; "ALARA Levels for Effluents from Materials Facilities," July 1993.

A major concern of the RBWG was selection of criteria to define the average member of the "critical group" for use in dose calculations. F. van Dorp proposed that the "critical group" might be defined as a hypothetical "self-sufficient agricultural community." It would be composed of four families of four persons each and of four additional adults (two grandparents and two "assistants"). Members of this group would be considered to have received the highest dose in time and space. F. van Dorp also proposed that the RBWG consider the development of criteria to circumscribe the size and locations of "self-sufficient communities" in order to avoid any controversy associated with their locations and sizes in the multiplicity of possible "future states."

Dr. John Kessler (Manager, Fuel Reliability, Storage and Disposal, Nuclear Power Division, Electric Power Research Institute) volunteered to chair a RBWG sub-committee that would develop criteria to define the critical group. Dr. Kessler's background is in Nuclear Engineering and his Ph.D. in Geo-Hydrology. He is expected to develop preliminary criteria by summer 1995. Presumably, his interest in this concept is related to the definition of the critical group recently proposed by EPRI to the NAS.

DEVELOPMENT OF CONCEPTUAL MODELS FOR THE BIOSPHERE

The RBWG has a procedure under development to facilitate the combinations of the important FEPs into reference scenarios that can then be used to prepare a conceptual model to characterize a reference biosphere. The RBWG tentatively decided to explore the Rock Engineering Systems (RES) approach to this problem. In the RES methodology the most significant elements of a conceptual model are identified (e.g., release of radionuclides, climate, etc.) and are listed along the diagonal of an "interaction matrix"; lesser elements are listed along the off-diagonal positions. The numerous interactions between the FEPs, between elements on the off-diagonal and diagonal matrix positions, can then be identified and used to define the conceptual model.

The RBWG plans to meet at Harwell, England on May 22, 1995 to determine the feasibility of the RES approach.

REPORT ON THE COMPLEMENTARY STUDIES WORKGROUP:

The chairman of the Complementary Studies Workgroup is R. Klos of the Paul Sherrer Institute, Switzerland.

DETERMINISTIC TEST CASE FOR BIOSPHERE MODELS

In the first phase of this study, eight participants of BIOMOVs II independently calculated eight peak doses to the hypothetical inhabitants of a reference biosphere (a synthetic agricultural valley located in central Switzerland). The radionuclides I-129 and Np-237 (and its daughters U-233 and Th-229) were released from a hypothetical underground waste disposal facility and transported to several media found in this Swiss valley (the river water, an aquifer, and the sub-soil). Identification of many of the factors leading to differences in doses, which were assessed by the various models for period of 10,000 years, was possible since the results were based on a common data set for both input and model parameters.

STOCHASTIC TEST CASE FOR BIOSPHERE MODELS

The stochastic model phase of the study will employ regression techniques to determine the relative importance of model parameters on dose (and indirectly the significance of FEPs) as calculated by computer codes developed in five different countries. From these analyses the CSWG also expects to determine if five different conceptual models will assign the same relative importance to the same model parameters. From intercomparisons like this, the relative importance of FEPs, which are derived from these parameters, may also be determined. The FEPs which remain after screening out, and those that are less important, will be used to prepare a universal FEP list (and perhaps a conceptual model) as the foundation for a model of a reference biosphere. More information and a draft final report will be available by the fall of 1995.

REPORT ON THE UNCERTAINTIES & VALIDATION WORKGROUP (UVWG):

MODEL COMPLEXITY SUBGROUP

The chairman of the MCSG work group is Mark Elert, Kemakta Konsult AB, Sweden.

Eight members of this work group, who were given a simple soil conceptual model and a fixed set of soil parameters, were asked to calculate the concentration profiles and travel times to selected depths of a standardized soil column during the downward migration for three nuclides (Cs-137, Sr-90 and I-129). Future intercomparisons that will use models of increasing complexity, are expected to help define the magnitude of the uncertainties that can result when simpler models are used for consequence calculations. No firm conclusions were available at the time of this meeting.

NATURAL ANALOGUES SUBGROUP

Currently, model simulations use present-day model parameters to describe the

redistribution and accumulation of radionuclides in the biosphere over long-time periods (thousands of years). This study, which was proposed by U. Bergstrom, Studsvik EcoSafe, Sweden, has as its objective the improvement of the long-term estimates of biosphere parameters. The initial approach, a leaching study, would compare experimentally determined compositions of sediment profiles in a Swedish bay with land-based sediments derived from the sediments in this bay. There was little interest in this project.

SIGNIFICANT OBSERVATIONS:

A member of the French national radioactive waste management agency (ANDRA) proposed a separate follow-up (or parallel) study to BIOMOVs II, "Biosphere Evolution Studies: Data Acquisition." Its goals are to establish typical food chains and specific "critical groups" whose characteristics would change when future climatic conditions occur.

Julian Apostoaie, SENES, Oak Ridge, Tennessee, and Paul Barry, Canada, a senior member of the BIOMOVs II steering committee, have observed that members of the public assign greater credibility to the results of calculations by computer models when a "consensus" of results is obtained by more than one group of modelers.

The National Center for Environmental Health, Radiation Studies Branch and the Center for Disease Control and Prevention, Atlanta, Georgia, has hired Owen Hoffman, SENES, to explore the proper use of the mean, the median, or other parameters when they are employed to characterize a distribution function for doses generated from biosphere models.

RECOMMENDATIONS AS TO FURTHER PARTICIPATION:

I believe that the NRC staff should continue to follow the BIOMOVs studies until its close in 1996 for a number of reasons:

- (1) The methodology developed by the reference biosphere workgroup is expected to be useful to determine biosphere models for both high-level and low-level waste disposal sites.
- (2) The licensing of waste disposal facilities is expected to be greatly accelerated if all interested parties would agree to a reference biosphere developed for a specific site during the pre-licensing period.
- (3) Environmental assessments of risk at waste disposal sites may be more acceptable to members of the public if the NRC incorporates pertinent parts of the biosphere methodology, developed by international cooperation, into its own approaches.
- (4) The concept of a reference biosphere may be part of the regulatory requirements to be formulated in the next few years by the Environmental Protection Agency for the high-level waste disposal site at Yucca Mountain, NV.

We may wish to contribute to the conclusions of the BIOMOVs II studies. The fall meetings in 1995 and 1996 will provide NRC this opportunity. Draft final reports for all workgroups are expected to be available by Fall 1995 and are to be converted into final reports by Fall 1996, the close of BIOMOVs II. Much of the useful information that NRC could apply to the licensing of waste disposal sites will be found only in these reports.

VBIOMOVs II 5TH WORKSHOP

List of Attendees

Alexander Kryshev
Vladimir Lutkovsky
Gennady Lyashenko
Paul Martin

Charles Miller
Leif Moberg
Anna Mortimer
Shyam Nair
Robert Neel
Sverker Nilsson
Frank Pelz
Ring Peterson
Wolfgang Raskob
Cathy Read
Thomas Riesen
Pascal Santucci
Tatiana Sazykina
William Schell
Inmaculada Simon
Graham Smith
Yvonne Stiglund
Siegfried Strack
Tomoyuki Takahashi
Kathy Thiesson
Patsy Thompson
Orihiko Togawa
Lazlo Toro
Carlos Torres
Ulf Tveten
Paul Ujit de Haag
Catherine Valentin-Ranc
Frits van Dorp
Barbara Watkins
David Webbe-Wood
Roger Wilmot
Theo Zeevaert
Charley Yu
Don Lush
Allan Ashworth
Jean Koch
Siegfried Strack

Inst. of Exp. Meteorology, Russia
Ukrainian Hydrometeorological Inst.
Cybernetics Centre, UAAS, Ukraine
Env. Res. Inst. of the Supervising
Scientist, Australia
CDC, USA
SSI, Sweden
Intera, UK
Senes Oak Ridge
US NRC, USA
SKB, Sweden
WISMUT, Germany
AECL, Canada
KfK, Germany
L G Mouchel, UK
PSI, Switzerland
CEA-IPSN, France
Inst. Exp. Meteorology, Russia
Univ. Pittsburg, USA
CIEMAT/IMA, Spain
Intera, UK
Studsvik, Sweden
KfK, Germany
JAERI, Japan
SENEs Oak Ridge, USA
AECB, Canada
RISO Nat. Lab, Denmark
Rad. Hygined Lab, Romania
CIEMAT/IMA, Spain
Inst. for Energiteknikk, Norway
RIVM, Netherlands
ANDRA, France
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