Release

January 30, 2001

MEMORANDUM TO: Gary M. Holahan, Director
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

E. William Brach, Director
Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards

FROM: Farouk Eltawila, Acting Director /RA/
Division of Systems Analysis and Regulatory Effectiveness
Office of Nuclear Regulatory Research

SUBJECT: OBTAINING CAPABILITY TO GENERATE LATTICE PHYSICS PARAMETERS FOR MOX CORE ANALYSIS

Attached you will find outlined two scenarios that we have delineated with respect to obtaining a neutronics code to generate lattice physics parameters (such as few group neutron cross-sections, diffusion coefficients) for MOX core analysis. The two scenarios considered are for NRC to: (1) lease WIMS8 for 7 years, and (2) lease WIMS8 for only the first 2 years, and in parallel develop and maintain NEWT (within the SCALE code) for the remaining 5 years. For each scenario, the technical and cost consideration as well as some licensing considerations are given in the attachment.

Our recommendation is that we should follow scenario 2. We believe that pursuing this scenario would be in the best interests of the NRC in the long term. Under scenario 2, the NRC will be able to address MOX reactor physics issues, as well as spent fuel issues and be prepared to address the same issues for advanced fuel and reactor designs. This recommendation is based on the imminent precertification application of the Pebble Bed Modular Reactor (PBMR). Under option 1, the NRC will not have access to the WIMS8 source code and will not be able to make the necessary changes to accommodate the unique features of the PBMR. This can be easily accommodated in NEWT.

We look forward to receiving your response so that RES may proceed with the development of NEWT.

Attachment: As stated

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Attachment

Scenarios for obtaining lattice physics parameters for MOX core analysis

Assumptions:

(a) Some lattice physics code required initially and for 7 years thereafter.
(b) WIMS8 license fee is $50K/year.
(c) Cost of NEWT development is $250K (FY01), $250K (FY02), $250K (FY03); and in and beyond FY03, the incremental maintenance cost as part of the SCALE code is $100K/yr.

Two possible scenarios under consideration are:

1. Lease WIMS8 for 7 years
2. Lease WIMS8 for only the first 2 years, and in parallel develop and maintain NEWT (within the SCALE code) for the remaining 5 years

Technical and Cost Considerations

Cost Comparison

Scenario	FY01	FY02	FY03	FY04	FY05	FY06	FY07	Total
(1)	$50K	$50K	$50K	$50K	$50K	$50K	$50K	$350K
(2)	$250K	$250K	$250K	$100K	$100K	$100K	$100K	$1,150K

Scenario 1:

WIMS8 can be used immediately to generate lattice physics parameters for MOX core analysis, and would cost $350K to lease over 7 years.

Scenario 2:

WIMS8 can be used immediately, and for the next 2 years, to generate lattice physics parameters for MOX core analysis. After 2 years, NEWT would be well enough developed to be able to generate lattice physics parameters for MOX core analysis for the remaining 5 years. This scenario would cost $1,150K over 7 years but may be higher if the maintenance cost has been underestimated.

Some Licensing Considerations

Scenario 1:

Since there are a number of different lattice physics codes commercially available, most of the licensees would probably not be using WIMS8 in their analyses. Therefore the NRC would have a certain degree of independence in its licensing review. However under this scenario, the NRC would have no access to the source code and if code changes are needed for regulatory analysis, the NRC would have very little leverage in establishing the priorities and schedule for WIMS8 code modifications. Restrictions on access to WIMS8 and its source code will also limit the public's ability to scrutinize WIMS8 methods and algorithms and their limitations.

Scenario 2:

Under this scenario the NRC will have access to the NEWT source code, potentially enabling a better understanding of algorithms and their limitation, and the ability to modify the code in response to changing regulatory needs (e.g., the Pebble Bed Modular Reactor). This would allow the NRC to implement modifications in accordance to its schedule. Developing and maintaining NEWT within the SCALE code for NRC use would allow the NRC to have a more independent means of verifying licensee submittals.

The NEWT code provides a rigorous solution to the Boltzmann transport equation for generalized geometries, and thus would provide the NRC with a flexible capability applicable to numerous fuel designs and geometrical configurations (e.g. advanced fuel and reactor designs, such as the Pebble Bed Modular Reactor). When integrated into the SCALE code system as planned, the SCALE/NEWT analysis will have access to the full cross-section processing capabilities of the SCALE code system and the capability, via ORIGEN-S, to obtain integral fuel characterization parameters (e.g. decay heat, radiation source terms) as a function of burnup. SCALE/NEWT sequences will provide the NRC with the basic capability to address reactor physics issues for a variety of reactor and fuel designs while also improving the existing capabilities to obtain spent fuel characterization. Thus, this combined capability will meet the anticipated long-term need of both NRR and NMSS. The rigor, flexibility, independence, and public availability embodied in the planned SCALE/NEWT sequence should improve public confidence and promote transparency of NRC activities.