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FROM: Alexander P. Murray, Senior Chemical Process Engineer
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SUBJECT: RE: NMSS MEMORANDUM - "STATEMENT OF VIEWS ON
       CONTESTED ISSUES REGARDING APPEAL OF DIFFERING
       PROFESSIONAL VIEW CONCERNING MODELING CHEMICAL
       CONSEQUENCE EFFECTS FOR DETERMINING SAFETY
       REQUIREMENTS AT THE PROPOSED MIXED OXIDE (MOX) FUEL
       FABRICATION FACILITY (NMSS-DPV-2002-03),"
       DOCKET NUMBER: 070-03098

I have just received a copy of the subject memorandum, dated October 7th, 2004, which responds to my memorandum of May 13th, 2004, and my DPO Appeal, dated September 21st, 2004. This represents a turnaround time of some five months. This memorandum contains misinterpretations and errors, and does not appear to be in alignment with the strategic plan and NMSS values. The memorandum obfuscates and overlooks the important safety issues involved. I note the generic applicability of the computer code used. However, for the proposed MOX facility, the NRC is reviewing a license application that uses a code for safety determinations without adequate assurance of site specific application and quality assurance to NRC standards, including site specific verification and validation of code results against actual site measurements. These safety concerns are further exacerbated by the code potentially under-predicting concentrations by one order of magnitude or more, as compared to other NRC-endorsed software and recent site applications by other organizations. Therefore, potential accident scenarios at the proposed facility may not have adequate safety strategies and design bases, as required by the regulation for a construction permit. The DPV notes that generic safety issues affecting other facilities may also be present.

I note the following examples of omissions and errors in the subject memorandum:

1. The subject memorandum (page 1) states the DPO appeal does not identify any perceived procedural or technical weaknesses in the NMSS decision. This obfuscates the issues involved with the DPV, including the following:
    -   the DPV panel essentially agreed with the DPV (a safety issue)
    -   the original NMSS decision agreed with the DPV panel (a safety issue)
    -   the FCSS actions did not address the main safety issues of adequate documentation for site specific use and NRC standards for software quality assurance (QA) and code validation/verification for NRC safety determinations, including site specific use (procedural and technical weakness)
    -   NMSS tacit (and actual) acceptance of the FCSS actions for issue closure (procedural and technical weakness)
    -   technical and safety concerns in the DPV submitter's memoranda of January 22nd, May 13th, August 5th, and September 21st, 2004 (technical weakness).

2. The subject memorandum (page 1) states there are no regulatory requirements for tracer studies. This is an erroneous statement. Part 70.23(b) states:

    "The Commission will approve construction of the principal structures, systems, and components [PSSCs] of a plutonium processing and fuel fabrication plant [e.g., a MOX facility] ... when the Commission has determined that the design basis of the [PSSCs], and the quality assurance program, provide reasonable assurance of protection against natural phenomena and the consequences of potential accidents."

    The ARCON96 code has been used in the MOX application to determine the adequacy of PSSCs and design bases, and the consequences of potential accidents. Hence, its use directly interacts with the regulation - if the code has not been appropriately tested against actual site conditions (e.g., verification and validation, usually accomplished by tracer studies), then the NRC cannot make a safety conclusion of reasonable assurance of protection based upon an unverified and unvalidated code.

3. Pages 2 and 3 of the subject memorandum omit the factual basis that a code without adequate QA, including verification and validation (e.g., comparison of code output to actual site concentrations, such as from tracer studies) cannot be used with any certainty to make safety conclusions. Page 2 of the original, NMSS Decision on the DPV and page 2 of the DPV Panel Report package state this sentiment, in programmatic language, such as:

    "... The reasonableness of the MOX applicant's specific application of the ARCON96 code and its results for safety related decision-making may involve consideration of the applicable and more important code modifications, assumptions, data input, data output, interpolations, and uncertainties ..."

Note that this is in the context of site specific application of the ARCON96 code and the information provided to the panel in mid-2003 by the Section Chief, program manager, and a MOX license reviewer (i.e., the prevailing opinion). In response to questions from the DPV Panel at the time, I was asked my assessment of the information provided to the Panel by the staff with the prevailing opinion, including the RAI information cited in the subject memorandum (clearly the Panel had seen the RAI information). I responded that this was all input data - there were no comparisons of output with actual concentrations from tests or releases at the site. Thus, a classic computer modeling concern exists - how well do the predictions match the specific site results? As noted on page 3 of the DPV panel report, "independent" testing was only done of the mathematics of the generic ARCON96 code algorithm. No comparisons were made to site data to verify and validate the code for specific site use.

4. Page 3 of the subject memorandum also briefly discusses the quality assurance of the codes. No mention is made of verification and validation of the ARCON96 code. As noted on page 6 of the DPV Panel Report, various managers and staff involved with codes offered they were not aware of the guidance in NUREG/BR-0167 and Volume 2 of the Management Directives. Hence, while it is not surprising that such QA guidance was dismissed by the prevailing staff opinion in subsequent memoranda, such ignorance does not address the need for software quality assurance, including verification and validation of code predictions against actual site results.

5. I also note that, per NUREG/BR-0167, the ARCON96 code is Level 1 software, used to make a safety decision. This NUREG cites numerous guidelines for software, including verification, validation, and associated testing. Section 3.2.4.3 actually mentions formal testing (basically, do the code predictions match actual results?), and cautions the reader not to confuse formal testing with formal proof-of-correctness methods (i.e., checking the mathematics, such as done by the prevailing opinion [see Item 3, above] and in the generic ARCON96 manual [NUREG/CR-6331]). The prevailing view appears to be confusing the proof-of-correctness with formal testing of predictions versus actual results, and, thus, the guidance has not been followed and the code has not been verified and validated for specific site use for the MOX facility.

6. Page 4 of the subject memorandum mentions QA of the ARCON96 code, maintained at ORNL. This is interesting but misses the point entirely. Volume 2 of the Management Directives and NUREG/BR-0167, "Software Quality Assurance Program and Guidelines," offer strong guidance for codes used in safety-related decision making, including verification and validation (i.e., comparison of code predicted concentrations to experimantally measured concentrations) for site specific use. Surprisingly, FCSS stated that neither the directive nor the NUREG offered guidance that was useful to the staff's review of the MOX application. However, without site specific verification and validation, code results cannot be supported. As noted in the DPV, DOE SRS has previously used the standard Gaussian dispersion model (i.e., this produces higher estimated concentrations) - no information has been provided or placed on the docket that supports ARCON96 model verification and validation for SRS and MOX use.

7.   The importance of software quality assurance cannot be overlooked. In Section 15.1 of the staff's revised Draft Safety Evaluation Report on MOX (April 2003), the applicant committed to meeting the requirements of NQA-1 for quality assurance; this was found to be acceptable to the staff. NQA-1 includes such key phrases as, "The computer program shall be verified to show that it produces correct solutions ..." and "The encoded mathematical model <u>shall be shown to produce a valid solution to the physical problem associated with the particular application</u>" (Requirement 3 - "Design Control" - paragraph 401 - "Use of Computer Programs" - my emphasis added). Requirement 11 - "Test Control" - has similar statements related to verifying "... that the computer program produces <u>correct results</u>" (my emphasis added). As a safety reviewer, I could not find this verification/validation information on the MOX docket. The DPV Panel also could not find this information and the concern became part of Recommendations 1 and 2 in the Panel's report, and was endorsed by NMSS in its action memorandum. Note that this may indicate the applicant is not adequately following its commitment to NQA-1.

8.   Page 4 of the subject memorandum makes the statement that the DPO Appeal Submitter has not provided any information as to why the results of the ARCON96 code are non-conservative. This is fallacious - page 2 et seq of the DPV provides comparisons showing the ARCON96 code producing non-conservative values as compared to the ALOHA code, for the same or similar.input values. In addition, this concern about under-predicting concentrations is found in NUREG/CR-6331 (May 1997), "Atmospheric Relative Concentrations in Building Wakes;" for example, Figure 27 shows considerable disparities and variations between the ARCON96 predictions and tracer studies at seven reactor sites. Figure 28 also shows significant variability as compared to observed concentrations. Again, this indicates non-conservative predictions by ARCON96 and implies the need for site-specific tracer studies to verify and validate the ARCON96 code, including modifying correction factors.

I am neither an advocate nor a detractor of the proposed facility - I am impartial. However, as the lead reviewer for chemical safety at the proposed facility, I am looking for reasonable assurances of adequate safety in the review of the MOX Construction Authorization Request (CAR). I remain concerned that this important safety issue is not being adequately addressed in the spirit and intent of the NRC Strategic Plan.

The NRC is a public agency and I have requested that all DPV related information (reports, memoranda, E-mails etc.) is released to the public. For this DPV/DPO, please ensure that all of these memoranda and related E-mails are made publically available and available on the MOX licensing docket.

Please contact me if you have any questions.

cc:
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