UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 30, 2003

MEMORANDUM TO: Martin J. Virgilio, Director
Office of Nuclear Material Safety and Safeguards

FROM: Charles Miller, Chairman
Differing Professional View Panel

SUBJECT: DPV PANEL REPORT: REVIEW OF "DIFFERING PROFESSIONAL VIEW ON MODELING CHEMICAL CONSEQUENCE EFFECTS FOR DETERMINING SAFETY REQUIREMENTS AT THE PROPOSED MIXED OXIDE FUEL FABRICATION FACILITY," DOCKET NUMBER: 070-03098 NMSS-DPV-2002-03

In your December 23, 2002, memorandum regarding the titled subject, you appointed an ad-hoc panel to review the merits of a differing professional view (DPV) submitted by Mr. Alex Murray, an NRC senior chemical safety reviewer. (A copy of Mr. Murray's DPV was attached to the memorandum.) Panel members included Panel Chairman Charles Miller (NMSS), Stephen McGuire (NSIR), and Walter Schwink (NMSS). The Panel has completed its review of the DPV and reports in the attached DPV Panel Report, its findings and recommendations for your consideration. As described in the Report, some of Mr. Murray's views were found to have merit.

Mr. Murray's DPV pertains to the NRC's ongoing review of the 10 CFR Part 70 license application for construction and operation of a Mixed Oxide (MOX) fuel fabrication facility located on the DOE Savannah River site near Aiken, South Carolina. The DPV concerns risks to the site workers, public, and environment related to potential hazardous releases. There is mention of financial liability, which could result from potential accidents, and repercussions on the U.S. meeting its international obligations for plutonium disposition.

Mr. Murray's specific safety concern is that chemical consequences to the MOX facility workers, public, and environment may be significantly understated if NRC allows the use of the ARCON 96 automated scientific code and therefore, safety measures may not be implemented. His concerns are related to what (if any) controls are determined necessary (based on consideration of ARCON 96 results) for preventing and mitigating accidents involving chemical hazards. His other concerns are generic in nature and pertain to NRC endorsement of automated scientific codes.

The DPV Panel's review, findings, and recommendations concerning Mr. Murray's DPV are detailed in the attached report. The Panel's findings and recommendations are summarized below.

DPV Position 1

Mr. Murray requests that "...the decision accepting the use of a less conservative code and parameters be over-turned."

The DPV Panel found that ARCON 96 code documentation indicates the code is a suitable tool for analyzing potential chemical consequences for a MOX fabrication facility. Regulatory Guides and NUREGS documenting the NRC's development, endorsement, and acceptance of the ARCON 96 code clearly indicate the code is generally appropriate for modeling the generic phenomena involving dispersion of hazardous material releases. In this regard, the code is characterized as general in nature, (i.e., models generic phenomena involving dispersion of hazardous material). Therefore, the DPV Panel recommends not granting Mr. Murray's request, to overturn the FCSS decision accepting the ARCON 96 code for modeling dispersion of hazardous material releases at the MOX facility.

However, the DPV Panel recommends that FCSS ensure that the MOX license application docketed information include the applicant's technical rationale demonstrating the reasonableness of the use of ARCON 96 results for MOX safety related decision-making and the Safety Evaluation documents the NRC staff's consideration of the applicant's code results and supporting rationale. The reasonableness of the MOX applicant's specific application of the ARCON 96 code and its results for safety related decision-making may involve consideration of the applicable and more important code modifications, assumptions, parameter values, algorithm option selection, diffusion coefficient adjustments, data input, data output, interpolations, and uncertainties. Both RG 1.194 and NUREG/CR-6331 provide generic guidance for application of the ARCON 96 code and its results for safety related decision-making.

DPV Position 2

Mr. Murray requests that "NMSS establish a position on the use of codes, estimation techniques and parameters that is consistent, peer reviewed, conservative, provides adequate assurances of safety and defensible."

The DPV Panel notes that results from automated scientific codes (i.e., analytical tools) are only one consideration in the regulatory process for determining adequate assurances of safety. Other elements of the regulatory process including defense in depth and robust requirements are also important for adequate assurances of safety. In this context, the Panel found that suitable documentation exists to guide NRC development, endorsement, and acceptance of automated scientific codes. Also, the Panel found that the ARCON 96 code is documented sufficiently for license reviewers to ascertain the suitability of the code for its specific application to conditions at the MOX facility. The DPV Panel recommends that Mr. Murray's request (DPV Position 2) be addressed by ensuring managers and staff involved with development, endorsement, use, or acceptance review of automated scientific codes are familiar with relevant sections of Volume 2 of the NRC's Management Directives and NUREG/BR-0167, Software Quality Assurance Program and Guidelines pertaining to automated scientific codes used for safety related decision-making. Also, the DPV Panel recommends that a collaborative

process involving agency stakeholders (e.g., NMSS, NRR, and RES) be established for coordinating Program Office needs for development and application of automated scientific codes that are suitable for use for NMSS and NRR applications. This will contribute to NMSS efforts for ensuring licensing reviewers sufficiently understand codes, their specific applications, and results to determine their reasonableness for safety related decision making. To the extent practicable, other regulators (e.g., EPA, NOAA, OSHA, and DOE) and stakeholders should be informed about NRC development and application of generic scientific codes when appropriate. In this regard, a NRC public web page could be established to inform internal and external stakeholders about NRC code work.

<u>DPV Position 3</u>

Mr. Murray requests that "NMSS address the fundamental problem of reconciliation of significantly different results from computer code, models, and approaches listed in its guidance."

The DPV Panel is of the view that different results are possible when applying different automated scientific codes to the same phenomena (e.g., dispersion of hazardous material release). This is due in part to the codes being based upon different conceptual models and incorporating different assumptions and parameters. Rather than reconcile these differences, the Panel concluded that it is more important to determine which code is appropriate (i.e., reasonable) for the intended use, e.g., providing site specific condition input for consideration in safety related decision-making. In this regard, the license reviewer needs to understand what about the code, its application, and its results are most important for safety related decision-making. Comporting with application specific conditions and safety related importance, this may include the code's intended versus actual use, technical basis, assumptions, parameters, conceptual models, algorithms, coefficients, data inputs and outputs, interpolations, interpretations, uncertainties. A variety of means can be used for reviewers to acquire code knowledge, skills, and experience, e.g., reading code documentation, seminars, colloquiums, classroom training, self study/practice, discussions with code developers and users, and participation in code development and endorsement. The license applicant using a code for license specific application should provide justification concerning the suitability of the code (i.e., specific application of the code and its results for safety related decision-making) for consideration by the license reviewer. The DPV Panel recommends that NMSS ensure that license reviewers using or reviewing codes and their license specific application results understand the code's suitability for its specific use. Their understanding should be sufficient for reviewers to determine what code is appropriate (i.e., reasonable) for its intended use, its site specific application, and its results.

<u>Other Considerations</u>

Mr. Murray views his DPV and its resolution as important safety related information that should be available for consideration by internal and external stakeholders in the on-going MOX licensing activities. In this regard, he has requested in writing that his DPV and its resolution be

made available to the ACRS, ASLB, the and public. The DPV Panel recommends that copies of Mr. Murray's DPV, the Panel's Report, and the NMSS Director's Decision for resolving the DPV be made available to the ACRS, ASLB, and the public (e.g., ADAMS, NRC MOX web page).

Attachment:

REPORT OF THE AD-HOC PANEL CONVENED TO REVIEW A DIFFERING PROFESSIONAL VIEW ON "MODELING CHEMICAL CONSEQUENCE EFFECTS FOR DETERMINING SAFETY REQUIREMENTS AT THE PROPOSED MIXED OXIDE FUEL FABRICATION FACILITY," DOCKET NUMBER: 070-03098 (NMSS-DPV-2002-03).

REPORT OF THE AD-HOC PANEL CONVENED TO REVIEW A DIFFERING PROFESSIONAL VIEW ON "MODELING CHEMICAL CONSEQUENCE EFFECTS FOR DETERMINING SAFETY REQUIREMENTS AT THE PROPOSED MIXED OXIDE FUEL FABRICATION FACILITY DOCKET NUMBER: 070-03098"

(NMSS-DPV-2002-03, submitted by Alex Murray)

Charles L. Miller

Charles Miller, Chairman

Stephen A. McGuire

Stephen McGuire, Member

Walter Schwink

Walter Schwink, Member

Attachment

Date: September 30, 2003

Purpose

In a memorandum dated December 23, 2002, the Director of the Office of Nuclear Material Safety and Safeguards appointed an ad-hoc panel to review the merits of a differing professional view (DPV) submitted by Mr. Alex Murray, a senior chemical safety reviewer in the Division of Fuel Cycle Safety and Safeguards (FCSS). (A copy of Mr. Murray's DPV was attached to the memorandum.) Panel members included Panel Chairman Charles Miller (NMSS), Stephen McGuire (NSIR), and Walter Schwink (NMSS). The purpose of the review by the Ad-Hoc Panel was to determine the merits of Mr. Murray's differing professional view (DPV), and make recommendations to the NMSS Director for resolving any issues of merit. NRC Management Directive (MD) 101.59, "Differing Professional Views or Opinions" provides guidance for review of DPVs.

Background

Mr. Murray's DPV pertains to the NRC's ongoing review of the 10 CFR Part 70 license application for construction and operation of a Mixed Oxide (MOX) fuel fabrication facility located on the Department of Energy (DOE) Savannah River site near Aiken South, Carolina. Regulatory oversight of the site is shared between DOE, EPA, OSHA, State and Local governments, and NRC (when MOX fabrication is licensed). NRC regulation of MOX related hazardous chemicals is limited to those chemicals that could degrade or fail engineered and human performance relied on for radiological safety or safeguards, chemicals co-mingled with radioactive material, and chemicals released from uranium bearing compounds. NRC's regulatory jurisdiction is described in a Memorandum dated March 10, 2003, from R. Pierson to C. Paperiello with the subject: "REGULATORY AUTHORITY OVER CHEMICAL HAZARDS AT FUEL CYCLE FACILITIES."

The DPV concerns risks to the site workers, public, and environment related to potential hazardous releases. There is mention of financial liability, which could result from potential accidents, and repercussions on the U.S. meeting its international obligations for plutonium disposition. Mr. Murray's specific safety concern is that chemical consequences to the MOX facility workers, public, and environment may be significantly understated if NRC allows the use of the ARCON 96 automated scientific code and therefore, safety measures may not be implemented. His concerns are related to what (if any) controls are determined necessary (based on consideration of ARCON 96 results) for preventing and mitigating accidents involving chemical hazards. His other concerns are generic in nature and pertain to NRC endorsement of automated scientific codes.

In the docketed MOX application, the applicant addresses hazardous material (nuclear and chemical) safety related risks to the workers, public, and environment. The NRC's regulatory jurisdiction for hazardous chemicals is limited to those that are: in direct contact with nuclear material, part of a nuclear material bearing compound, released from a nuclear material bearing compound, or likely to fail engineered or human performance relied on for nuclear material safety or safeguards. Other chemicals are not under NRC jurisdiction and are regulated by other federal, state, and local government agencies. MOX site specific hazardous chemical related release scenarios, dispersions, and consequences are analyzed by the MOX applicant to determine what (if any) preventive and/or mitigative controls (engineered and human performance) are needed to control risks to acceptable levels in a accordance with regulatory

performance) are needed to control risks to acceptable levels in a accordance with regulatory requirements. In determining consequences of potential releases of hazardous chemicals regulated by the NRC, the MOX applicant used the ARCON 96 automated general scientific code as a tool to evaluate the potential hazardous chemical release dispersion to MOX site areas, structures, systems, equipment, and workers relied on for nuclear material safety and safeguards.

The MOX application briefly describes the ARCON 96 code and references NUREG/CR-6331, "Atmospheric Relative Concentrations in Building Wakes." NUREG/CR-6331 documents NRC's development, endorsement, acceptance, and user guidance for the the ARCON 96 code to model dispersion of hazardous releases. The MOX applicant has not provided sufficient justification for the appropriateness of MOX specific application of the code for modeling dispersion of potential hazardous releases at the MOX site. According to FCSS management and staff interviewed by the Panel the applicant's use of the ARCON 96 code is based on previous NRC development, endorsement, and acceptance of the code for modeling dispersion of hazardous releases at reactor sites. They are of the view that the ARCON 96 code is a generic code (tool) for evaluating generic phenomena involving the dispersion of potential hazardous material releases.

Mr. Murray's safety concern (differing view) results from FCSS acceptance of results from MOX specific application of the ARCON 96 code without a docketed applicant justification (i.e., explanation of why the general code reasonably models dispersion of hazardous material releases at the MOX site (e.g., MOX site specific code modifications, assumptions, parameter values, algorithm options, diffusion coefficient adjustments, data input, data output interpretations)) supporting the appropriateness of the general code for MOX site specific modeling of the dispersion of potential hazardous chemical releases. Specifically, he is concerned, that In the absence of such justification, the applicant's use of the ARCON 96 code (results) will result in significant understatement of MOX safety related risks considered in deciding what (if any) controls are necessary for preventing and mitigating accidents involving chemical hazards. In this regard, Mr. Murray requests that "the decision accepting the use of a less conservative code and parameters be over-turned." Mr. Murray's request is referred to and addressed by the DPV Panel as DPV Position 1.

Another concern expressed in Mr. Murray's DPV is the lack of a collaborative process (involving internal and external stakeholders) for agency development, endorsement, and acceptanceof automated scientific codes. In this regard, Mr. Murray requests that "NMSS establish a position on the use of codes, estimation techniques, and parameters that is consistent, peer-reviewed, conservative, provides adequate assurances of safety, and defensible [this could be a Branch Technical Position (from the Fuel Cycle Facilities Branch) or a separate guidance document (say, a NUREG document)]." Mr. Murray's request is referred to and addressed by the DPV Panel as DPV Position 2.

In discussions with the DPV Panel, Mr. Murray offered that he is concerned about what he considers are risk significant differences in results from various generic automated scientific codes (e.g., ARCON 96, ALOHA) used to model dispersion of the same or similar hazardous material. As an example, he offered the difference in results from the generic ARCON 96 code and ALOHA using MOX applicant data. He noted that differences in results among codes are noted in NUREG/CR-6410, Nuclear Fuel Cycle Facility Accident Analysis Handbook. He

offered that regulatory guidance is not provided for NRC reviewer and license applicant reconciliation of these differences. In this regard, Mr. Murray requests that "NMSS address the fundamental problem of reconciliation of significantly different results from computer codes, models, and approaches listed in its guidance." Mr. Murray's request is referred to and addressed by the DPV Panel as DPV Position 3.

<u>Discussion</u>

The DPV Panel focused its review on Mr. Murray's requested actions, i.e., DPV Positions 1, 2, and 3. In addition to reading the DPV, the MOX application, and other documents deemed relevant, the Panel met with Mr. Murray (at his request) to clarify his views and provide additional information. As suggested by Mr. Murray, the Panel also met with the MOX Project Manager (PM), the PM's supervisor, and another MOX chemical safety reviewer in FCSS, who accepted ARCON 96 results. In addition, Panel members discussed with NRR staff, their development, acceptance, endorsement, and use of generic automated scientific codes (e.g., ARCON 96) for modeling the dispersion of hazardous releases.

Mr. Murray is of the view that FCSS should not accept the results from MOX specific application of the ARCON 96 code without a docketed applicant explanation of why the code is a reasonable tool for modeling dispersion of potential hazardous material releases at the MOX site. For example, the explanation should address MOX site specific code modifications, assumptions, parameter values, algorithm options selection, diffusion coefficient adjustments, data input and data output. Specifically, he is concerned, that In the absence of such explanation, the applicant's use of the ARCON 96 code (results) will result in significant understatement of MOX safety related risks considered in deciding what (if any) controls are necessary for preventing and mitigating accidents involving chemical hazards. His view is based on running the ALOHA code (EPA and NRC accepted code) and comparing the results with those from the ARCON 96 code. He offered that although he is not familiar with the ARCON 96 code and has not run the code, the comparison of results between the codes shows that the ARCON 96 code results from the applicant are significantly different than the results from the ALOHA code. Details of the comparison supporting Mr. Murray's views are included in his DPV submittal. Albeit Mr. Murray offered differences among the results from the codes, he did not offer any technical reasons that the use of the ARCON 96 code was not appropriate as used by the applicant for modeling potential hazardous material releases at the MOX site.

As explained to the DPV Panel by NRC's MOX licensing Project Manager (PM), the PM determined that the ARCON 96 code and its results were acceptable for MOX safety related decision-making, e.g., determining what chemical hazard controls are needed. He offered that Mr. Murray's differing views were considered in determining the acceptability of the generic ARCON 96 code and its results for safety related decision-making. The PM noted that his determination resulted from discussions and meetings with FCSS licensing reviewers and the MOX license applicant.

In discussions with the PM's Section Chief, the Panel was told that he was aware of differing staff views on the acceptability of the generic ARCON 96 code but, did not disagree with the PM's determination that the code and its results were acceptable. In discussions with a MOX license reviewer, the Panel was told that he agreed with acceptance of the generic ARCON 96 code based on his independent testing of the generic ARCON 96 code algorithms (math

equations) and considering site conditions during which hazardous chemical releases could occur. In his view, the ARCON 96 code and its results offered reasonable conservatism and therefore are acceptable for MOX site specific safety related decision-making.

No reasons were offered to the DPV Panel concerning why MOX site specific results from the ARCON 96 code are not reasonable for safety related decision-making. Conversely, no explanation was offered to the Panel concerning why MOX site specific code results are reasonable for safety related decision-making.

DPV Position 1:

Mr. Murray requests that "...the decision accepting the use of a less conservative code and parameters be over-turned."

Mr. Murray noted that NUREG-1718, Standard Review Plan for Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility (SRP) characterizes hazardous chemical dispersion modeling as highly uncertain and therefore warrants conservatism, which he believes is lacking in the ARCON 96 code results. In this regard, he noted that a conservative estimate of potential consequences is called for in NUREG-1520, Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility. Mr. Murray supports his views about ARCON 96 with technical rationale in his DPV submittal which includes a detailed comparison of MOX site specific results from ARCON96 and ALOHA. Mr. Murray did not offer reasons why ARCON 96 results are not reasonable or why ALOHA results are reasonable. The results included concentrations and comporting doses involving the following hazardous chemicals: N2H4, HNO3, HAN, N2H4H2O, N204, and UO2. Mr. Murray's concern is that the ARCON 96 code results will cause no or inadequate controls ("items relied on for safety") to be identified for prevention and mitigation of severe consequences involving potential releases of hazardous chemicals. He told the Panel that a NRC acceptable docketed applicant explanation is needed to document why the ARCON 96 code reasonably models dispersion of potential hazardous material releases at the MOX site. The explanation should address MOX site specific code modifications, assumptions, parameter values, algorithm options, diffusion coefficient adjustments, data input, data output and uncertainties.

Mr. Murray offered that he is not knowledgeable about NRC development, endorsement, and acceptance of the ARCON 96 code. He noted that the applicant has not provided for NRC review, an explanation for why the MOX site specific code results are reasonable. In this regard, he believes that the applicant should be required to submit such information for NRC review before accepting the code results for MOX safety related decision-making.

Mr. Murray did not offer any technical reasons supporting his view that use of the ARCON 96 code results was not appropriate for MOX applicant safety related decision-making.

<u>DPV Panel Findings and Recommendations:</u>

The Panel found that NRC had developed and endorsed the general ARCON 96 code, which is a tool, for evaluating hazardous material dispersion at nuclear power plants. The code is general in nature and reasonably models generic phenomena (i.e., dispersion of hazardous material) and, therefore, is generically applicable to any site including fuel cycle facilities. The

reasonableness of site specific application of the code including its results (e.g., at the MOX site) requires explanation and acceptance of site specific code modifications, assumptions, parameter values, algorithm option selection, diffusion coefficient adjustments, data input, data output, interpolations, and uncertainties. Documentation indicates that the ARCON 96 code has evolved from continuing research, experience, and industry and NRC staff views. In the 1980s, the NRC sponsored studies to evaluate the existing (e.g., Murphy-Campe) models against experimental testing in the environment and in wind tunnels and to develop alternative approaches. The results of these studies were published in 1988 in NUREG/CR-5055, "Atmospheric Diffusion for Control Room Habitability Assessments." The results indicated that the existing dispersion models (including those currently used in ALOHA) overestimated concentrations during low wind speed conditions and in the vicinity of buildings.

The reason that concentrations were overestimated during low wind speeds was that the dispersion parameters used for estimating the spread of the plume were based on experiments done during relatively high wind speed conditions. When wind speeds are high, normally there is little variability in wind direction. During low wind speed conditions, wind direction is much more variable. The variability in wind direction has the effect of spreading the plume and lowering concentrations. The reason that concentrations were overestimated near buildings is that the building causes turbulence that expands the size of the plume in the building's wake. ARCON 96 was designed to correct for both the low wind speed and building wake effects. The correction is often called the "building wake effect," but in fact, the correction accounts for both the low wind speed effect and building wake effect. At low wind speeds, the low wind speed correction is the dominant correction. The developers of the ALOHA code have recently recognized that ALOHA overestimates concentrations at low speeds, and they are now planning to incorporate the low wind speed correction into future versions of ALOHA.

NUREG/CR-5055 presented a statistical diffusion algorithm (automated scientific code) that made significantly more accurate predictions in building wakes. This was peer reviewed in 1994 by a formal panel comprised of recognized atmospheric dispersion experts including representatives from NOAA, EPA, DOE, NRC, and industry. The code was revised in response to this peer review and included in a code referred to as the ARCON 95 code. Stakeholder (public, industry, and regulators) comments on the code resulted in modifications made to the code and its re-issuance as the generic ARCON 96 code. The code is described as including improved low wind speed and building wake dispersion algorithms for assessment of ground level, building vent, elevated, and diffuse source release modes; use of hour-by-hour meteorological observations; sector averaging; and directional dependence of dispersion conditions. This results in a more reasonable model of dispersion with less uncertainty, which requires less conservatism than other codes.

NRC REGULATORY GUIDE 1.194, ATMOSPHERIC RELATIVE CONCENTRATIONS FOR CONTROL ROOM RADIOLOGICAL HABITABILITY ASSESSMENTS AT NUCLEAR POWER PLANTS, endorses the generic ARCON 96 code with guidance for its site/facility specific use and acceptance. The REG GUIDE (RG) notes that ARCON 96 results may show significantly less hazardous material concentrations and therefore less potential dose than would be shown using results from other codes (e.g., ALOHA). The generic ARCON 96 code also is endorsed in NRC REGULATORY GUIDE 1.78, EVALUATING THE HABITABILITY OF A NUCLEAR POWER PLANT CONTROL ROOM DURING A POSTULATED HAZARDOUS CHEMICAL RELEASE. Guidance for use of the generic ARCON 96 code is provided in NUREG/CR-6331,

Atmospheric Relative Concentration in Building Wakes. Use of the ARCON 96 code in nuclear power reactor licensing actions has survived challenges by internal and external stakeholders (e.g., ACRS, ATOMIC SAFETY AND LICENSING BOARD (ALSB NO. 99-762-02-LA)), the Nuclear Regulatory Commission, UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA (CASE Nos. 01-1073 & 01-1246).

The DPV Panel found that ARCON 96 code documentation indicates the code is a suitable tool for analyzing potential chemical consequences for a MOX fabrication facility. Regulatory Guides and NUREGS documenting the NRC's development, endorsement, and acceptance of the ARCON 96 code clearly indicate the code is generally appropriate for modeling the generic phenomena involving dispersion of hazardous material releases. In this regard, the code is characterized as general in nature, i.e., models generic phenomena involving dispersion of hazardous material. FCSS licensing reviewers for chemical safety could learn more about the ARCON 96 code (including its technical basis/conservatism) from the aforementioned NRC documents and through collaborative discussions with NRC staff cognizant for the code. Therefore, the DPV Panel recommends not granting Mr. Murray's request, to overturn the FCSS decision accepting the ARCON 96 code for modeling dispersion of hazardous material releases at the MOX facility.

However, the DPV Panel recommends that FCSS ensure that the MOX license application docketed information include the applicant's technical rationale demonstrating the reasonableness of the use of ARCON 96 results for MOX safety related decision-making and the Safety Evaluation documents the NRC staff's consideration of the applicant's code results and supporting rationale. The reasonableness of the MOX applicant's specific application of the ARCON 96 code and its results for safety related decision-making may involve consideration of the applicable and more important code modifications, assumptions, parameter values, algorithm option selection, diffusion coefficient adjustments, data input, data output, interpolations, and uncertainties. Both RG 1.194 and NUREG/CR-6331 provide generic guidance for application of the ARCON 96 code and its results for safety related decision-making.

DPV Position 2:

Mr. Murray requests that "NMSS establish a position on the use of codes, estimation techniques and parameters that is consistent, peer reviewed, conservative, provides adequate assurances of safety and defensible."

<u>DPV Panel Findings and Recommendations</u>:

In discussions with various managers and staff, the DPV Panel found that the ARCON 96 code was not developed and endorsed in collaboration with FCSS staff responsible for chemical safety reviews. The code is a tool that was developed for nuclear power plant safety related decision-making. This accounts for why FCSS chemical safety reviewers are not familiar with the technical basis for NRR development, endorsement, and acceptance of the code.

Various managers and staff involved with codes offered that they were not aware of NUREG/BR-0167, Software Quality Assurance Program and Guidelines, for scientific code development consistent with Volume 2 of NRC MDs. Except for code validation dictated by the intended use of a code, a "value added warranting costs" rationale was offered by various staff

experienced in code development for not following such guidance (e.g., validation and verification, for all codes developed by the NRC for safety related decision-making (e.g., risks involved with code results did not warrant time and effort for code validation and verification)).

The DPV Panel notes that results from automated scientific codes (i.e., analytical tools) are only one consideration in the regulatory process for determining adequate assurances of safety. Other elements of the regulatory process including defense in depth and robust requirements are also important for adequate assurances of safety. In this context, the Panel found that suitable documentation exists to guide NRC development, endorsement, and acceptance of automated scientific codes. Also, the Panel found that the ARCON 96 code is documented sufficient for license reviewers to ascertain the suitability of the code for its specific application to conditions at the MOX facility. The DPV Panel recommends that Mr. Murray's request (DPV Position 2) be addressed by ensuring managers and staff involved with development, endorsement, use, or acceptance review of automated scientific codes are familiar with relevant sections of Volume 2 of the NRC's Management Directives and NUREG/BR-0167, Software Quality Assurance Program and Guidelines pertaining to automated scientific codes used for safety related decision-making. Also, the DPV Panel recommends that a collaborative process involving agency stakeholders (e.g., NMSS, NRR, and RES) be established for coordinating Program Office needs for development and application of automated scientific codes that are suitable for use for NMSS and NRR applications. This will contribute to NMSS efforts for ensuring licensing reviewers sufficiently understand codes, their specific applications, and results to determine their reasonableness for safety related decision making. To the extent practicable, other regulators (e.g., EPA, NOAA, OSHA, and DOE) and stakeholders should be informed about NRC development and application of generic scientific codes when appropriate. In this regard, a NRC public web page could be established to inform internal and external stakeholders about NRC code work.

DPV Position 3:

Mr. Murray requests that "NMSS address the fundamental problem of reconciliation of significantly different results from computer code, models, and approaches listed in its guidance."

<u>DPV Panel Findings and Recommendations:</u>

The DPV Panel is of the view that different results are possible when applying different automated scientific codes to the same phenomena (e.g., dispersion of hazardous material release). This is due in part to the codes being based upon different conceptual models and incorporating different assumptions and parameters. Rather than reconcile these differences, the Panel concluded that it is more important to determine which code is appropriate (i.e., reasonable) for the intended use (e.g., providing site specific condition input for consideration in safety related decision-making). In this regard, the license reviewer needs to understand what about the code, its application, and its results are most important for safety related decision-making. Comporting with application specific conditions and safety related importance, this may include the code's intended versus actual use, technical basis, assumptions, parameters, conceptual models, algorithms, coefficients, data inputs and outputs, interpolations, interpretations, uncertainties. A variety of means can be used for reviewers to acquire code knowledge, skills, and experience, e.g., reading code documentation, seminars,

colloquiums, classroom training, self study/practice, discussions with code developers and users, and participation in code development and endorsement. The license applicant using a code for license specific application should provide justification concerning the suitability of the code (i.e., specific application of the code and its results for safety related decision-making) for consideration by the license reviewer. The DPV Panel recommends that NMSS ensure that license reviewers using or reviewing codes and their license specific application results understand the code's suitability for its specific use. Their understanding should be sufficient for reviewers to determine what code is appropriate (i.e., reasonable) for its intended use, its site specific application, and its results.

Other Considerations:

Mr. Murray views his DPV and its resolution as important safety related information that should be available for consideration by internal and external stakeholders in the on-going MOX licensing activities. In this regard, he has requested in writing that his DPV and its resolution be made available to the ACRS, ASLB, and the public. The DPV Panel recommends that copies of Mr. Murray's DPV, the Panel's Report, and the NMSS Director's Decision for resolving the DPV be made available to the ACRS, ASLB, and the public (e.g., ADAMS, NRC MOX web page).