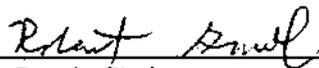


ENVIRONMENTAL MOLECULAR SCIENCES LABORATORY (EMSL)

READINESS ASSESSMENT (RA) REPORT

August 1997

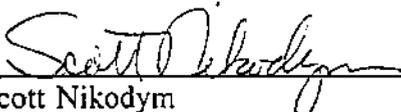
Review Team Members:

  
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Robert Gruel, Chairman  
EMSL Readiness Assessment Team

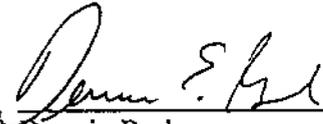
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Jim Minor  
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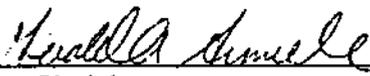
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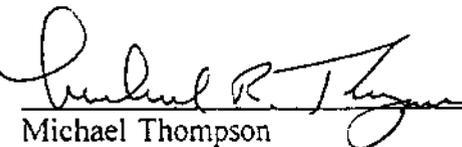
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Dennis Ryder  
Quality Assurance

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Jerry Simiele  
Environmental & Waste Management

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Michael Thompson  
Equipment Systems

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## EXECUTIVE SUMMARY

The purpose of this Environmental Molecular Sciences Laboratory (EMSL) Readiness Assessment (RA) Report is to describe the review that has been conducted and the conclusions that have been reached regarding verification that facility and management systems are ready to permit full-scale operation of the EMSL in a safe and environmentally sound manner.

Since early April 1996 the members of the PNNL RA Team have reviewed the EMSL processes, examined the facility, and met with members of the facility staff for the purpose of assessing the state of operational readiness of the facility, and to recommend whether the facility was ready for operations. This review was conducted in accordance with both the Memorandum of Understanding (MOU) between DOE-RL and the Pacific Northwest National Laboratory (PNNL) and the EMSL RA Plan which was approved by DOE-RL. These documents define and provide the basis for a two-stage approach: an interim operations readiness decision followed by a full-scale operations assessment.

The PNNL RA Team previously documented its interim operation review in its April 1997 RA report. That report served as part of the basis for the DOE-RL decision to approve interim operations on May 5, 1997. The DOE-RL approval of interim operations letter identified several post-start items to be completed by PNNL. These items have been appropriately resolved and are described in Appendix B. The full-scale operations assessment evaluated the EMSL on a research space specific-basis. The PNNL RA Team evaluated the readiness declarations of all EMSL research and computer equipment (except as noted in the PNNL declaration of readiness) and their associated research space and, upon resolution of any issues, concurred with the EMSL Operation's recommendation to PNNL management to allow conduct of research activities within the specific research space. DOE-RL approval is required on two of these research equipment systems, the accelerator and the 900 MHz NMR. DOE-RL approval of accelerator operation was granted on July 8, 1997. The DOE-RL approval letter for accelerator operation also identified several post-start items to be completed by PNNL. These items have been appropriately resolved and are described in Appendix B. The 900 MHz NMR has not been approved for operation and is listed as an exception to the PNNL declaration of readiness.

After reviewing the facility, equipment, and management systems in accordance with the processes described in the MOU and the RA Plan, and having verified the resolution of outstanding items identified in the DOE-RL and PNNL reports related to interim operation and operation of the accelerator, the PNNL RA Team recommends that the Environmental Molecular Sciences Laboratory be approved for full-scale operation. The 900 MHz NMR has not been approved for operation and is listed as an exception to the PNNL declaration of readiness. A small number of research spaces and their associated research equipment are also not yet complete and are also listed as exceptions to the PNNL declaration of readiness.

## OPERATIONS ASSESSMENT

### REVIEW PROCESS

The purpose, scope, objectives, and methodologies used by the RA Team to gather the information necessary to come to a judgment as to the operational readiness of the facility are detailed in the Memorandum of Understanding (MOU) between DOE-RL and PNNL and the EMSL RA Plan which was approved by DOE-RL. As noted therein, a graded approach was used in the assessment of readiness for the EMSL. The method chosen to perform the graded approach to the EMSL is comparison against "best practices" which calls for an overall approach to EMSL operations and identification of specific elements for review. The result of this best practices determination is described in the EMSL Operations System (EMSL Ops) and is captured in the EMSL RA Implementation Plan which contains an EMSL IP Checklist for each of the facility and equipment systems. The checklists for each of the systems specifies the facility requirements, equipment requirements, staff requirements, and operational software requirements necessary to define operational readiness. The level of detail in these checklists has been jointly determined by a DOE-RL/PNNL implementation planning working group and therefore was not verified nor validated by the RA Team.

A readiness assessment checklist was generated by EMSL operations personnel for each of these systems which identified the specific actions that needed to be accomplished to demonstrate completion of the EMSL IP Checklist items. The readiness assessment checklists were used by EMSL operations personnel to prepare an acceptance package for each system. The RA Team determined that these checklists did serve as a useful tool to help ensure readiness of the facility systems.

The acceptance packages provided the base level of information used by the RA Team during their evaluation. The RA Team used the information provided in the acceptance packages to ensure acceptable facility and equipment characteristics. Where existing PNNL procedures or processes were used by the EMSL, the RA Team focused its review on their interface with the EMSL, not on the PNNL procedures or processes themselves, unless specific findings indicated otherwise. Additionally, every item within the acceptance package for each system was not individually assessed. Rather, a subset of the items based upon importance (e.g., safety significance) was examined, and evaluation of additional items was conducted if warranted based upon the results of the initial review.

The RA Team was responsible for determining which methods of verification were used in its evaluation, and ultimately conducted the evaluation using a variety of techniques including performance-based inspections, document reviews, and interviews.

PNL-MA-97. *Operational Readiness Review System*, was used as additional guidance for this review. Appendix A to this report describes the RA evaluation from the PNL-MA-97 perspective.

## REVIEW TEAM

Each RA Team member was assigned a primary role during the RA. The RA Team members associated with the interim operations assessment and their respective primary roles are as follows:

<u>RA Team Member</u>	<u>Primary Role</u>
Robert Gruel	RA Team Chairman
Jim Minor	Facility & Management Systems
Scott Nikodym	Occupational Safety & Health
Dennis Ryder	Quality Assurance
Jerry Simiele <sup>1</sup>	Environmental & Waste Management
Michael Thompson	Equipment Systems

Team members did not limit their review to the noted areas, and staff not assigned to the RA and other resources as necessary were frequently used to adequately review each system.

## REVIEW RECOMMENDATIONS

The three areas surveyed were the facility and its utility systems, research equipment and its associated research space, and the management systems.

### FACILITY REVIEW

The facility review focused on the seventeen utility systems that serve EMSL. These facility systems were reviewed to determine if they were acceptable from each of the following perspectives:

- Design Basis Information: The equipment design standards (drawings, specifications, workplans, operating information, etc.) and any applicable regulatory (environmental, industrial, occupational, radiation, etc.) requirements.
- Functional Acceptance: The acceptance or component testing conducted to demonstrate conformance with design objectives and requirements (safety checks and interlocks, capacity and connected load documentation, etc.).
- Operations (including Training and Staffing): The user/machine interface and associated requirements (personnel staffing, qualification, and training; facility and equipment operation; procedures; etc.) and controls (required processes, permits, plans, etc.).

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<sup>1</sup> Jerry Simiele assumed responsibility for this role following the departure of Marcel Ballinger.

- Maintenance (including Training and Staffing): The maintainability requirements (surveillances, preventative maintenance, calibrations, staff training needs, etc.) and other related information (maintenance manuals, maintenance contracts, spare part needs, etc.).

The following sections document the conclusions of this review.

### Design Basis Information

The facility was subjected to a vigorous design and review process as defined in PNL-MA-90, *Design: Preparation, Control & Implementation*. This process was integrated into the EMSL project through the *Engineering Design Plan*, EMSL-EDP-001 (EDP). The EDP identifies the following primary controlling documents:

- *EMSL Quality Assurance Plan*, EMSL-QAP-001,
- *EMSL Functional Design Criteria (FDC) Document*, EMSL-FDC-001,
- Several Supplemental Requirements Documents, EMSL-SRD-001 through 007,
- *EMSL Project Management Plan*, EMSL-PMP-001, and
- *EMSL Change Control Procedure*, EMSL-CCP-001.

The EMSL was designed in accordance with extensive criteria which is identified in Section 2 of the revised *EMSL Final Safety Evaluation (FSE)*, dated July 1997. Design verification methods included formal and informal design reviews, independent technical reviews, and board reviews. Participants in the reviews included representatives and subject matter experts from: the using organization, the DOE's Laboratory Management Division, and PNNL's Technical Services, Safety, Safeguards and Security, Process Quality, and Property Management and Accounting organizations. Consultants and an offsite architectural and engineering firm were also involved in the development and reviews of designs. Formal reviews were performed at the 30, 70 and 90 percent completion stages.

The RA Team reviewed the FDC and FSE to ensure that the facility was designed with appropriate emphasis on safety. The RA Team evaluated a sample of the design modifications (change requests) made to the facility to ensure that an appropriate change review process was in place and that this safety perspective was not compromised. Based upon this review, and given the extent of the reviews performed by subject matter experts to both define the Functional Design Criteria and develop the approved designs, the RA Team concludes that the process used regarding the Design Basis Information topic area is appropriate and acceptable.

### Functional Acceptance

Acceptance testing of facility systems equipment is the responsibility of the A/E firm and the vendor firm, with PNNL providing subsequent approval. The Test Director for the vendor firm arranges performance of the detailed acceptance test procedure (ATP), with the A/E firm

witnessing each step of the test. The A/E firm then may approve the test results without exception, with exceptions resolved, or with exceptions outstanding. Final test approval and acceptance by the A/E firm occurs after exceptions have been resolved or scheduled for resolution. PNNL agreement is obtained for final test approval, after PNNL has reviewed the procedure and PNNL comments have been resolved. Upon completion of designated portions of the facility, an Acceptance of Completed Work (ACW) is documented and approved by the A/E firm and PNNL. The ACW typically includes a number of punchlist items that require resolution.

The RA Team reviewed the ATPs for each of the systems to determine the adequacy of the testing and the acceptability of the results from a safety perspective. Members of the RA Team observed several of these tests to ensure they were conducted in a safe and appropriate manner. Based upon these reviews and observations, and given that the process described above should be effective in helping ensure that the necessary activities associated with this topic area have been adequately identified and implemented, the RA Team concludes that the process used regarding the functional acceptance topic area is appropriate and acceptable.

### Operations

The process for ensuring that the facility systems could be operated safely by facility staff included:

- Issuance of Safe Operation Procedures (SOPs) prepared in accordance with PNL-MA-50, *PNL Operations Manual*,
- Selection and qualification of the Power Operators and Air Balance Operators in accordance with the *EMSL Power Operator Training Plan*, Rev. 3,
- Selection and qualification of a Building Manager, Facility Engineer, and Fire Protection Engineer based upon their past education and experience, and
- Other miscellaneous actions (e.g., issue of fuel oil and chemical contracts).

The RA Team verified that the Power Operator qualification has been completed, that the SOPs were walked down as part of this qualification process, and that the SOPs have been issued and are available in the control room for those facility systems required for operation. Based upon these verifications and observations, the RA Team concludes that the process used regarding the operations topic area is appropriate and acceptable.

### Maintenance

The process for ensuring that the facility systems could be maintained safely by facility staff included:

- Development of preventative maintenance (PM) procedures (or equivalent, i.e., placement on third party inspection list),
- Selection and qualification of crafts people needed to support EMSL Operations in accordance with a Maintenance Services Department training plan, and
- Selection and qualification of a Facility Engineer and a Maintenance Services Department specialist based upon their past education and experience.

The RA Team verified that the assigned crafts people have completed their training, that the identified PMs have been scheduled for issuance, and that applicable procedures have been developed for those facility systems required for interim operations. Based upon these verifications and observations, the RA Team concludes that the process used regarding the maintenance topic area is appropriate and acceptable.

#### Facility Equipment Pre-start and Post-start Items

At the time the interim operations was approved, facility construction and testing was not complete. The remaining items were categorized as either 1) critical for the safe operation of the facility or 2) not required for interim operations and could therefore be completed at an appropriate later date. The former items were therefore referred to (from an interim operations perspective) as pre-start items; the latter as post-start items. All of the pre-start punchlist items were completed or otherwise resolved prior to gaining DOE-RL approval for interim operations. Several items remained as post-start items as documented in the DOE-RL approval of interim operations letter dated May 5, 1997. The RA Team has evaluated the resolution of these items and concurs that they are appropriately resolved; their disposition is identified in Appendix B.

#### EQUIPMENT REVIEW

Once the research and operations staff had concluded their preparation for and assessment of readiness of each research space, a declaration of readiness package was submitted to the RA Team for each research space. Each package contained the following components:

- ES&H RA Questions for Individual EMSL Spaces
- Chemical Management System Inventory Listing
- Self-Assessment Checklist (Facility Perspective)
- Construction status memo
- Self-Assessment Checklist (Research Perspective)
- Hazard Awareness Summary
- Training Requirements for the Cognizant Space Manager
- Equipment Readiness Declaration

The elements of each of these components, and the RA Team perspectives on each, follows.

## ES&H RA Questions for Individual EMSL Spaces

Early in the process, both the operations staff and the RA Team noted the need for checklists to provide a common evaluation base for each of the research spaces. This questionnaire served as the holistic check of the process to ensure that each of the more specific checks were appropriately accomplished. The RA Team suggested several additions to the initial version of this document, and has determined that the final product provides a good summary of the readiness status of the applicable research space.

## Chemical Management System Inventory Listing

The Chemical Management System (CMS) Inventory Listing is intended to provide an accurate listing of the specific chemicals contained in each research space. The RA team found that in general the CMS inventory accurately reflected the chemical constituency of a research space, but was often not in complete agreement with the actual chemicals contained in that space. There were a number of reasons for this, each of which is documented in the applicable declaration package; they are best summarized as pertaining to operational startup, movement of equipment and chemicals into the EMSL from other buildings, and uncertainties associated with chemicals inventory requirements. Inventory startup issues have largely been resolved, and once all movement of equipment and chemicals from other PNNL locations is complete, the CMS inventory will be much more accurate. Issues regarding chemical inventory requirements and access to and availability of material safety data sheets (MSDSs) have been raised to the PNNL level, and SBMS practice update will provide more specific guidance in this regard.

## Self-Assessment Checklist (Facility Perspective)

These checklists provide a mechanism for the facility staff (typically the Building Manager) to assess the readiness of the research space from their perspective. Although concerns occasionally arose regarding the completeness of the checklists or the status of the readiness of the space as documented, these concerns were always quickly and appropriately resolved, and this checklist served an important role in assuring that the research space was ready for use by research staff.

## Construction status memo

This memo provided a means of documenting the construction status of each research space and was used by the RA Team to determine if construction issues needed to be addressed with the researcher responsible for the research space, the cognizant space manager (CSM).

## Self-Assessment Checklist (Research Perspective)

This checklist was similar to its facility counterpart, but was used by the researcher as a self-examination in preparations of the facility (and RA Team) walkthrough. Although, as

with its facility counterpart, the RA Team found some concerns with respect to the attention to detail regarding the answers provided, this checklist served an important role in assuring that the research space was ready for use by research staff. This checklist will also serve a permanent role in ensuring that the research space is maintained in an appropriate manner as the checklist is to be revisited on a quarterly basis to ensure nothing has occurred which will adversely affect the research space work environment. As such, the RA Team recommends that the checklist be updated to help ensure it fills this important role.

### Hazard Awareness Summary

The Hazard Awareness Summary (HAS) is the cornerstone of lab access and use. It provides information regarding the space, its cognizant space manager (CSM), and the equipment within the space, and a specific listing and description of the hazards associated with the space and the associated fact sheets, EMSL Practices, and SBMS standards. It also provides reference and access (when viewed electronically) to applicable permits, including chemical processing permits, laser use permits, and non-ionizing radiation permits. The HAS appropriately serves as the primary source of information that must be read to gain access to a research space.

The HAS for each space was reviewed by the RA Team and any issues were appropriately resolved as noted in each specific declaration package. This included a review of any applicable permits associated with the space. Any concerns specific to the space under review were appropriately resolved as part of the review process; however, some more generic issues exist and are recommended to be resolved on a PNNL basis.

### Training Requirements for the Cognizant Space Manager

The RA Team examined the training requirements for each CSM to verify that each had been trained with respect to the appropriate hazards that exist within their space, and discussed with the CSM the importance of ensuring that training requirements were addressed for staff requesting research space access. The RA Team members exercised this system by requesting passive (no use of lab equipment nor active involvement with space hazards) access to each space. This required the CSM to interface with EMSL Ops to determine if appropriate training requirements had been met prior to granting the requested access. A recurring comment by the CSMs was the need to be able to easily determine the training requirement status of all staff who have (or have requested) access to their lab. This capability should be implemented as soon as feasible.

### Equipment Readiness Declaration

The equipment readiness declaration provided information with respect to the same line of questions identified for facility systems in the previous section regarding equipment design basis information, functional acceptance, operations, and maintenance. An equipment readiness declaration for each piece of research equipment was included in the declaration

package for the research space. These equipment declarations were reviewed as described in the following section.

### Research Equipment and Facility Space Assessment Methodology

Upon receipt of the declaration of readiness package for a specific research space, the RA Team first conducted a tabletop review of the information provided to address any documentation issues. The RA Team then scheduled two separate walkthroughs with the CSM, one based on a research equipment perspective and the other based on a research space perspective. This methodology was used due to the inherently different skill sets of the reviewers required in each case.

The research equipment assessment included an inspection of the equipment in the research space and discussion with the CSM or primary user regarding acceptance procedures, user training requirements specific to the equipment, and maintenance and operating procedures. This review was conducted for all EMSL research and computer equipment specified in WBS 2.1.X through 2.7.X (except as noted in the PNNL declaration of readiness).

The research space assessment, conducted for every research and computer space (except as noted in the PNNL declaration of readiness), included an examination of a number of items including the following (if applicable):

- the EMSL Laboratory Handbook to ensure that it contained the appropriate self-assessment checklists and hazard awareness summary, the latest version of the EMSL Practices, and appropriately documented procedures, and permits,
- the chemical inventory to assess the accuracy of the CMS,
- the satellite accumulation area to assess appropriate storage and documentation of chemical wastes, and
- overall research space issues such as hazard postings, emergency response and egress, general cleanliness, etc.

Upon conclusion of each review, any findings were resolved and were documented in research equipment- and research space-specific memos that were included with the declaration for readiness. The RA Team Chairman signed the declaration attesting to the acceptable completion of the review, and the declaration was submitted to PNNL line management for approval in accordance with the MOU and RA Plan.

DOE-RL approval is required on two of these research equipment systems, the accelerator and the 900 MHz NMR. DOE-RL approval of accelerator operation was granted on July 8, 1997. The DOE-RL approval letter for accelerator operation identified several post-start items to be completed by PNNL. These items have been appropriately resolved and are described in Appendix B. The 900 MHz NMR has not been approved for operation and is listed as an exception to the PNNL declaration of readiness.

## MANAGEMENT REVIEW

The RA Team has assessed the EMSL Management System with respect to its ability to support the activities, both currently ongoing and to be conducted, within the facility. The RA Team has followed the assessment approach described in the MOU and RA Plan. Specifically, the RA Team has manipulated for evaluation purposes a 'test space' within the EMSL management system tool (EMSL Ops), evaluated the conclusions of the operations assessment conducted by the Independent Oversight Department, conducted facility and research laboratory walkthroughs, interviewed a number of operations staff, interviewed all of the facility cognizant space managers (CSMs) and most of the research equipment (laboratory) space CSMs, and examined a number of the EMSL Laboratory Handbooks located throughout the EMSL.

The RA Team found that the EMSL management system represents a novel, conceptual approach to operational management in that it provides an acceptable methodology that can be used to effectively, efficiently, and safely operate the EMSL. The management system provides an appropriate interface to the Standards Based Management System (SBMS), and is used to identify and address potential hazards within the facility and research laboratory space. The staff interviewed strongly support the management concept and were using it to the extent appropriate at this time. EMSL Laboratory Handbooks were located in appropriate laboratory spaces, were complete to the extent practical, and adequately described and addressed the hazards currently present.

One important practice within the EMSL Laboratory Handbook, *Use of EMSL Prior to Completion of RA Process for Individual Labs*, received detailed scrutiny from the RA Team. It provides additional guidance that is applicable to facility staff during interim operations. The content and restrictions contained in this practice were deemed appropriate by the RA Team and included:

- Prohibition of research activities until a laboratory is released
- Restrictions on chemicals, flammable liquids and gases, and toxic gases
- Restrictions on process effluents
- Requirements on staff working within the facility
- Building emergency response requirements
- First aid and chemical spill kit location
- Eye wash and safety shower use information
- Injury or exposure to toxic material response information
- Facility access information

There were a number of additional issues resulting from the RA review that relate to the management assessment of the EMSL. Examples of items that were evaluated by the RA Team included the Building Emergency Response Organization (BERO) and assignment and training of zone wardens; adequacy of staff orientations conducted prior to authorizing facility access; life-safety issues related to egress posting, fire alarm and suppression equipment, and

response to emergencies; approval status of the Facility Use Agreement (FUA); operational restrictions on chemicals and flammable liquids and gases; appropriate distinction between requirements and guidance in the Standard Practices; appropriate use of carboys, sinks and drains; proper procedures and posting of areas including laser warnings, field strength limitations near magnets, high voltage warnings, and radiation zones related to the accelerator; asphyxiant gas concerns; and appropriate spill prevention plans, waste discharge permits, and procedures for 90-day and satellite waste storage areas. RA Team's concerns in each of these areas were adequately addressed by EMSL facility staff, except for those that were noted as post-start items in the interim RA report. These items have been subsequently satisfactorily addressed and their resolution is addressed in Appendix B.

The RA Team evaluated EMSL Ops use during interim activities and concluded that the management system was being appropriately used. The RA team continued to evaluate the EMSL Ops process during its review to determine the acceptability of allowing research activities to be conducted within specific individual research laboratory spaces. The RA Team concludes that the management system has been appropriately used and that its continued use will help ensure the safe operation of the EMSL.

## CONCLUSION

After reviewing the facility, equipment, and management systems in accordance with the processes described in the MOU and the RA Plan, and having verified the resolution of outstanding items identified in the DOE-RL and PNNL reports related to interim operation and operation of the accelerator, the PNNL RA Team recommends that the Environmental Molecular Sciences Laboratory be approved for full-scale operation.

## APPENDIX A

### PNL-MA-97, Operational Readiness Review System

This appendix provides details of the RA Team's activities from the perspective of PNL-MA-97, *Operational Readiness Review System*. The boldface sections correspond with the core requirements listed in Appendix B of PNL-MA-97, modified to be appropriate for use regarding the EMSL RA, as contained in approved RA Plan.

**1. There are adequate and correct procedures and safety limits for operating the process systems and utility systems.**

The *Final Safety Evaluation* (FSE) has been completed and approved by the PNNL Safety Review Committee (SRC). The RA Team has reviewed the FSE to ensure that administrative and equipment controls that are required for interim operations are in place and functioning properly. More detail regarding the FSE is provided in Item 4.

The procedure generation, review, approval, and distribution process has been evaluated and relies on existing PNNL standards, resulting in an adequate facility operating procedure program. Specifically, the RA Team has verified that:

- operating procedures are prepared, reviewed, and approved in accordance with PNL-MA-50, *PNL Operations Manual*.
- operating procedures were walked down by subject matter experts (SMEs) and by the Power Operators
- controlled copies of the operating procedures are available in the control room.

In addition, several specific procedures were examined to verify that the process was being appropriately used. Examples include procedures regarding:

- power operator round sheets
- facility utility system procedures including:
  - electrical
  - backup power
  - compressed air
  - heating water
  - chilled water
- facility process system procedures including:
  - liquid effluent system operation
  - effluent system local alarm indications and operator response
  - liquid effluent sampling and monitoring

2. **Training and qualification programs for operations and operations support personnel have been established, documented and implemented (the training and qualification program encompasses the range of duties and activities required to be performed).**

The RA Team evaluated the adequacy of the EMSL power operator qualification process and the implementation of that process. These activities included a verification of:

- selection of individuals that were current in their qualification and training as power operators in other PNNL-managed facilities.
- identification of the EMSL facility systems for which the power operators and air balance operator will require training.
- adequacy of the qualification process for the power operators as documented in the *EMSL Power Operations Training Plan, Rev. 3*.
- involvement of the power operators in the walk-down of the SOPs as part of their qualification process.
- oral examinations of the power operators for each of the identified facility systems as part of their qualification process.
- adequacy of the documentation of the power operator qualification for each of the identified facility systems (and relevant SOPs).

Additionally, the training and qualifications of the following EMSL support staff was evaluated and found acceptable:

- Building Manager
- Facility Engineer
- Environmental Safety and Health (ES&H) Representative
- Hazardous Materials and Environmental Compliance Representative (HMECR)

3. **Level of knowledge of operations and operations support personnel is adequate based on selected interviews of operating and operations support personnel.**

Interviews have been conducted with a variety of facility and support staff. These EMSL-related staff positions included:

- Operations Manager
- Building Manager
- Facility Engineer
- ES&H Representative
- HMECR
- Power Operators and Power Operator Supervisor
- Craftsmen and Craftsmen Supervisor

Many of these staff have been heavily involved in the design of EMSL Ops and the design, construction, and testing of the facility systems. These interviews demonstrated that the facility staff possess an adequate knowledge regarding their responsibilities related to facility operation.

4. Facility safety documentation is in place that describes the "safety envelope" of the facility. The safety documentation should characterize the hazards/risks associated with the facility, and should identify mitigating measures (systems, procedures, administrative controls, etc.) that protect workers and the public from those hazards/risks. Safety systems and systems essential to worker and public safety are defined, and a system to maintain control over the design and modification of facilities and safety-related utility systems is established.

The *Final Safety Evaluation* (FSE) has been completed and approved by the PNNL Safety Review Committee (SRC). The RA Team has reviewed the FSE and determined that administrative and equipment controls required for interim operations are in place and functioning properly, and will evaluate the remainder of the controls during evaluation of specific laboratory spaces.

Additional mitigating measures evaluated by the RA Team and found acceptable include:

- EMSL Ops is used to identify hazards associated with spaces within EMSL, and as the basis for training and medical qualification requirements.
- Laboratory Handbooks, including the hazard awareness summaries, are used to communicate hazard information to EMSL staff.

Item 7 provides additional discussion regarding the EMSL "safety envelope" as it pertains to conformance to external regulation.

Design and modification of the facility is governed by the EMSL Engineering Design Plan during the construction process. The RA Team evaluated a sample of the design modifications (change requests) made to the facility to ensure that an appropriate change review process was in place and that this safety perspective was not compromised. Following turnover to PNNL, PNL-MA-90, *Design: Preparation, Control & Implementation*, will apply.

The RA team evaluated a number of specific issues relative to personnel hazards. Examples include a variety of life safety issues regarding emergency response (e.g., posting of exits, emergency lights, egress routes, fire doors, fire extinguishers, spill response), asphyxiant gas, confined spaces, hazardous and radioactive materials, 90-day storage and satellite storage. Concerns in these areas were satisfactorily resolved during both the interim and full-scale operations evaluations.

5. **A program is in place to confirm and periodically reconfirm the condition and operability of safety systems, including safety-related process systems and safety-related utility systems. This includes examinations of records of tests and calibration of safety system and other instruments which monitor limiting conditions of operation or that satisfy TSRs. All systems are currently operable and in a satisfactory condition.**

The EMSL is a non-nuclear, low hazard facility, and therefore no limiting conditions of operation nor TSRs exist.

Acceptance test procedures (ATPs) have been conducted on facility systems to ensure they function as designed. The Facility Management System functions to monitor important facility parameters and will call attention to conditions that are outside established nominal parameters. The existing PNNL surveillance and preventative maintenance programs will be used to ensure appropriate equipment remains functional.

6. **A process has been established to identify, evaluate, and resolve deficiencies and recommendations made by oversight groups, official review teams, audit organizations, and the operating contractor.**

There are a number of adequate procedures/processes in place for dealing with identified issues. Formal processes include PNNL-wide systems such as the Corrective Action Tracking System (CATS) and the Review Comment Record (RCR). Informal processes are in place to address the findings contained in the Independent Oversight report as well as the findings of the RA Team. The RA Team has evaluated these informal processes and found their use adequate.

7. **A review of the facility's conformance to external regulation, as defined by the Standards Based Management System (SBMS), has been performed.**

EMSL Ops provides an interface between the facility staff and the SBMS. The information provided in and the use of the Laboratory Handbooks, specifically with regard to the EMSL Standard Practices, establishes linkages to the SBMS, which provides the PNNL interface to external regulations. The self-assessment process performed by the Cognizant Space Manager (CSM), and the Hazard Awareness Summaries that result from this process, establish the training requirements for staff who have access to the laboratory space. The RA Team finds that this process is functioning appropriately. The EMSL RA assessment has resulted in identification of several issues which have been brought to the attention of staff responsible for SBMS implementation for resolution on a PNNL level (examples include chemical inventory requirements, reference to outdated PNNL manuals, chemical storage in secondary containers, electrical hazard training for research staff, appropriate personal protection equipment use).

Conformance to additional regulatory requirements have been evaluated and determined to be adequate. Examples include:

- Environmental Assessment
- City of Richland Industrial Waste Discharge Permit
- Accidental Spill Prevention Plan
- Toxic Air Pollutant NOC
- Radioactive Air Emissions NOC
- RCRA limitations for the hazardous waste storage and handling

8. Management programs are established, sufficient numbers of qualified personnel are provided, and adequate facilities and equipment are available to ensure operations and operational support services (e.g., training, maintenance, waste management, environmental protection, industrial safety and hygiene, radiological protection and health physics, emergency preparedness, fire protection, quality assurance, and engineering) are adequate.

The RA Team has reviewed the approved *Facility Use Agreement* (FUA) and has determined that standards, permits and/or requirements are implemented for the facility to the extent necessary for interim operations. The RA Team has determined that sufficient support personnel have been assigned or are available to the facility. The following positions serve as examples of assignments evaluated and/or interviewed by the RA Team:

- Operations Manager
- Cognizant Space Managers
- Building Manager (and Building Emergency Director)
- Facility Engineer
- ES&H Representative
- HMECR
- EMSL Training Coordinator
- Radiological Control Technician
- Fire Protection Engineer
- Maintenance Services Department Manager
- Power Operators and Power Operator Supervisor
- Craftsmen and Craftsmen Supervisor

Many of the EMSL support activities were previously in place and functioning acceptably regarding EMSL-related activities being conducted in other facilities. The RA Team evaluated the adequacy of the issues as staff occupancy occurred and as research activities were undertaken and has determined that these support services remain adequate.

9. **A routine and emergency operations drill program, including program records, has been established and implemented.**

PNL-MA-11, *Emergency Preparedness*, contains the requirements concerning facility drills. The Building Emergency Response Procedure (BERP) is the primary document related to emergency preparedness and as such has received a great deal of scrutiny from the RA Team. The RA Team's concerns regarding the Building Emergency Response Organization (BERO), assignment and training of zone wardens, emergency response personnel access to the facility, frequency of planned drills, and the BERP revision process and schedule for updates throughout interim operations and on an annual basis thereafter were acceptably addressed. A building evacuation was witnessed and resulted in a determination that the vast majority of facility and contractor staff responded appropriately. The BERP and BERO has been acceptably updated as staff occupancy occurred so as to identify and provide training to additional zone wardens.

10. **An adequate start-up or restart test program has been developed that includes adequate plans for graded operations testing to simultaneously confirm operability of equipment, the viability of procedures, and the training of operators.**

The facility start-up test program consisted of the facility systems and a large number of research equipment systems, a small portion of which are not yet completed as noted in the PNNL declaration of readiness letter. Acceptance test procedures (ATPs) that have been conducted on the required portions of these facility and equipment systems acceptably ensure that they function as designed. Additional detail is contained within the *Review Recommendations* portion of this report.

11. **Functions, assignments, responsibilities, and reporting relationships are clearly defined, understood, and effectively implemented with line management responsible for safety.**

The EMSL line management structure has been in existence for some time and is currently, and will remain, responsible for safety. EMSL Ops implementation requires both the CSM and the applicable line manager to be aware of the hazards identified in the Self-assessment Checklist. The RA Team finds this process satisfactory.

12. **The implementation of conduct of operations functional requirements are adequate for operations.**

The DOE-RL approved EMSL Operations Transition Plan (OTP) documents that a graded approach to DOE order compliance is appropriate in that an operational standard relevant to the EMSL research oriented environment is desired. The method chosen to develop this standard for the EMSL was a comparison against "best practices" which called for an overall approach to EMSL operations and identification of specific elements for review. The result of this best practices determination is described in the

EMSL Operations System (EMSL Ops). As such, the conduct of operations (COO) process was not driven from the perspective of DOE 5480.19, but from an approach of what COO principles were necessary and sufficient regarding the EMSL. The EMSL Operation System, Version 4.0, System Requirements Specification, Appendix IX, contains an EMSL Ops / COO (DOE 5480.19) cross reference which shows where appropriate portions of the Order are reflected in EMSL Ops. The RA Team has reviewed the EMSL Ops COO approach from the "best practices" perspective and determined that it provides an appropriate approach for conduct of operations issues.

13. **There are sufficient numbers of qualified personnel to support safe operations.**

This issue is addressed in Item 8 above.

14. **A program is established to promote a culture in which personnel exhibit an awareness of public and worker safety, health, and environmental protection requirements and, through their actions, demonstrate a high priority commitment to comply with these requirements.**

The staff orientation training related to EMSL Ops has been reviewed and facility staff have been interviewed regarding their awareness of the subject area. The RA Team concludes that EMSL Ops has adequately promoted the desired culture.

15. **The facility systems and procedures, as affected by facility modifications, are consistent with the description of the facility, procedures, and accident analysis included in the safety basis.**

This guidance is applicable to the restart of a modified facility and is therefore not within the scope of this RA as noted in the RA Plan.

16. **Modifications to the facility have been reviewed for potential impacts on procedures and training and qualification. Procedures have been revised to reflect these modifications and training has been performed to these revised procedures.**

This guidance is applicable to the restart of a modified facility and is therefore not within the scope of this RA as noted in the RA Plan.

17. **The technical and management qualifications of contractor personnel responsible for facility operations are adequate.**

This issue is addressed in Item 8 above.

## APPENDIX B

### Outstanding Items

#### DOE-RL Items

- Punchlist items for office pod 1 and the administration wing need to be complete to support a phased move-in and occupancy -- *Complete; office pod 1, admin north, and admin south have been approved for occupancy.*
- Unsealed fire wall penetrations not required for life-safety code compliance are scheduled for completion prior to use of the facility under H-7 occupancy -- *Underway.*
- *Final Safety Evaluation (FSE)* issues have been identified which are to be corrected to meet the requirements of DOE 5481.1B prior to Key Decision 4 -- *Complete; the FSE has been formally revised.*
- EMSL Laboratory Handbook is updated to address secondary labeling of chemical containers consistent with the ASPP, fact sheets, and Chemical Use Permits prior to Key Decision 4 -- *Complete.*
- Risk & Prep revision will be evaluated for projects using EMSL facilities prior to initiation of work -- *Complete (ongoing).*
- 90-day waste storage areas and satellite accumulation areas will be in place and functional prior to initiation of research in the affected laboratory space -- *90-day area complete; remainder are put in place as waste streams are generated.*

#### Accelerator Readiness Assessment Poststart Items (97-STO-136)

- Develop appropriate procedures for the disposal of alkaline metals associated with the accelerator source -- *Complete*
- Provide assurance to RL that the accelerator complies with the requirements of 10 CFR 835, subpart K, "Design and Control" -- *Complete.*
- Address language in the Ion Beam Materials Analysis Laboratory (IBMAL) Standard Operating Procedure (SOP) that requires maintenance personnel to be categorized as "users," since "visitors" cannot perform work. This requires them to read the entire IBMAL SOP. Some type of "maintenance" or "special user" certification should be considered to address this burdensome requirement -- *Complete.*

- Address the description language of the "two man rule" in the SOP where it states that "user" certification is the minimum for the second person. In actuality, it is the minimum for either person since neither can viably be a "visitor" -- *Complete*.

### PNNL RA Report Items

- *Facility Use Agreement (FUA)* issues have been identified which are to be corrected prior to Key Decision 4 -- *Critical issues have been resolved, remaining minor issues will be addressed in the next scheduled revision.*
- BERO updates, including designation and training of additional zone wardens, will be evaluated -- *Complete (and ongoing)*.
- Remaining OAC and related items need to be completed:
  - ADP network needs to be functional and tested to support staff moves -- *Complete*.
  - HVAC system upgrade required to maintain cooling and differential pressure -- *no modifications are currently required.*
  - Steam boiler repair (and wall modification) -- *Underway.*
  - MSCF electrical cutoff device needs to be installed and tested -- *Complete.*
  - Fire system trouble alarm response issues need to be resolved -- *Complete.*
  - Fume hood testing needs to be completed before use -- *Complete for required fume hoods.*
- Helium Recovery System needs to be operational prior to use of the 900 MHZ NMR -- *Will be resolved concurrent with operational assessment of the 900 MHZ NMR.*
- Laser interlocks are operational and will be connected to lasers within their respective laboratory space prior to initiation of research in the affected laboratory space -- *Complete for all operational lasers.*
- Toxic gas monitoring equipment will be operational prior to allowing introduction of toxic gases into a particular laboratory space -- *Ongoing.*
- The EMSL Ops process will continue to be evaluated during interim operations to determine the acceptability of allowing research activities to be conducted within specific individual research laboratory spaces -- *Complete.*