



# **FY2001 Annual Self-Evaluation Report for the Pacific Northwest National Laboratory**

October 2001



Prepared for the U.S. Department of Energy  
for the Management and Operations of Pacific Northwest  
National Laboratory under Contract DE-AC06-76RL01830

---

# **FY2001 Annual Self-Evaluation Report for the Pacific Northwest National Laboratory**

**October 2001**

This document directly supports the DOE-RL Contract for the Management and Operation of the Pacific Northwest National Laboratory Contract DE-AC06-76RLO1830, Appendix E.

## Executive Summary

The Pacific Northwest National Laboratory's (PNNL) vision is to be a premier scientific institution, conducting research at the interfaces of the physical, life, and information sciences and technology. We intend to be numbered among the world's premier research laboratories, distinguished by scientific excellence, known for solving the U.S. Department of Energy's most critical and difficult problems, widely recognized for operational excellence, and highly valued by the community and region in which we operate. Our core purpose is to create new knowledge and deliver solutions to science and technology challenges in DOE's core missions. Our mission roles are closely aligned with the priorities identified in the *U.S. Department of Energy Strategic Plan* (DOE/CR-0070, September 2000), and in the DOE research and development portfolio.

This self-evaluation report provides a summary of results from FY2001 actions taken to achieve our strategy, our analysis of key strengths and areas for improvement, and an analysis of the state of our self-assessment program. Progress toward our strategy is chronicled through the Critical Outcomes we have established in partnership with DOE. The Department of Energy's FY2001 performance evaluation of the Laboratory is also based on our progress against these three Critical Outcomes; Scientific and Technological Excellence, Operational Excellence, and Leadership and Management. These Outcomes represent delivery of tangible results to DOE through our performance-based contract. For FY2001, we believe we have again exceeded DOE's performance expectations for each of the Critical Outcomes.

Based upon the evidence contained in this self-evaluation, the Laboratory's overall performance for the FY2001 evaluation period has been **Outstanding**. We have sustained a high level of performance in key areas important to us and to DOE while also gaining ground on three future-oriented initiatives. Those areas that require continued attention and improvement fully support our vision and our continued success. Performance

highlights and key issues for each of the Critical Outcomes are summarized below.

## Critical Outcome Performance

### Scientific and Technological Excellence

The Laboratory is conducting high-quality scientific work that is providing new insights and solutions to key technical issues facing the nation and the world. External peer reviews of major programs recognized our programs for the achievement of national and international recognition for excellence in experimental research, for the breadth of our research programs and for staff and facilities of the highest caliber. We are clearly contributing to issues important to the nation.

The Laboratory received significant external recognition in FY2001 including four R&D 100 awards, four FLC awards, and two Discover Magazine awards. In addition, the quality of our scientific efforts are reflected by the sustained list of staff that were recognized for their scientific and engineering excellence in terms of awards, invited talks, and participation on scientific committees.

Our publication rate appears to be relatively stable. The use of a 3-year rolling average allows us to better account for variability. More importantly perhaps is the fact that 35% of the journals we are publishing in are among the top ten for their subject area. However, we believe continued growth is important and will therefore continue to focus on publication productivity in the FY2002 and beyond.

Results indicate that we are positioned to create new research programs, consistent with our strategy, or are already beginning to do so in our Science mission. This is evidenced by PNNL being funded for its first two genome proposals within the Microbial Genome Program. The EMSL and ARM extended Research Facility continue to represent two national assets as evidenced by user satisfaction, publication productivity, growth and diversity of users, and peer review comments.

Our impact in the Environmental Quality mission area is demonstrated by our leadership roles on key EM programs, our contributions to technical issues that are critical to cleanup at Hanford and across the DOE complex, and the positive feedback we receive from customers and peer reviewers. Our leadership of EM's Tanks Focus Area continues to result in successful technology deployments across the DOE complex, resulting in high marks for effectiveness. Our work for the Environmental Management Science Program (EMSP) spans several elements of DOE's Environmental Quality Research and Development Portfolio. A 2001 R&D 100 Award for the Milliwave Viscometer and continued leadership in EMSP project awards serve as evidence to the continued quality of our EMSP work. We continue to successfully deliver technical solutions that result in time and cost savings and risk reduction for critical Hanford problems. Our Hanford Groundwater Vadose Zone work was characterized as "a prototype for EM-funded applied science programs." Our staff continue to provide key science and technology and strategic planning, management and assessment support to build and operate a Waste Treatment Plant to complete cleanup of Hanford's highly radioactive tank waste. We led a regional effort to identify constraints and challenges to Hanford cleanup that successfully brought DOE, EPA, and the Washington Department of Ecology to agreement to collectively address four major constraints to Hanford cleanup.

Our impact in the National Security mission area is demonstrated by the leadership we are given over key programs, the levels at DOE with which our staff provide information and the confidence DOE places upon that information, and the consistently positive feedback we receive from our customers. Through the work of the Pacific Northwest Center for Global Security, PNNL was exceedingly successful in increasing the visibility of the DOE Office of Nonproliferation and National Security (NN) programs with the northwest academic, non-governmental organizations (NGOs), and congressional communities. We helped establish what may be the first nonproliferation studies program at a publicly funded academic institution:

the Institute for Global and Regional Security Studies at the University of Washington. We were successful this year, with NN's guidance and encouragement, in elevating the concept of Russian debt conversion to a high level of interest in Congress, resulting in legislation introduced by several members, including Senators Biden and Lugar, and at least two separate letters from Congressmen to President Bush recommending the concept for consideration in advance of the June summit and the Genoa G8 meeting. Based on customer feedback, PNNL continues to perform in an outstanding manner in support of DOE's Office of Intelligence (IN). PNNL's analytical products routinely go directly to the Energy Secretary; the Administrator, NNSA; the DOE Assistant Secretaries; and the National Security Council thereby having a direct impact on national security and policy decisions. The Director of IN-1 indicated that PNNL staff detailed to DOE-IN and based in Washington, D.C. continue to provide an irreplaceable level of technical quality not available elsewhere in the federal government. Our ultimate indicator of performance in the Counterintelligence arena is satisfaction on the part of our customer, which continues to be rated as outstanding.

The quality and relevancy of the science and technology delivered in the Energy mission area is illustrated through the continued evolution of the Northwest Alliance for Transportation Technology and the lead role we have played in creation of the Solid-State Energy Conversion Alliance. PNNL supports the DOE Fossil Energy Office of Coal and Power Systems through its efforts in the Advanced Fuel Cell program and through its efforts to support the next generation of zero emission coal programs. This is best demonstrated by the leadership and technical contributions shown in the development and implementation of the Solid-State Energy Conversion Alliance (SECA) in partnership with the National Energy Technology Laboratory (NETL). PNNL is viewed by the DOE Office of Transportation Technology as having distinctive technical capabilities in after treatment chemistry and catalyst materials development, solid oxide fuel cells for essential power (auxiliary power), metallurgy, lightweight materials forming

and computational engineering and simulation. We have successfully developed intellectual leadership roles in several areas including non-thermal plasma, lightweight material forming, solid oxide fuel cell technology, and applied modeling.

While sustaining a high level of performance in our key mission areas, we also made substantive progress across our three key initiatives, which are supported in varying degrees by DOE. The Biomolecular Networks, Computational Sciences and Engineering and the Nanoscience and Nanotechnology Initiatives all comprise our effort to create leading-edge scientific capabilities focused toward achieving fundamental knowledge in biological, information, and physical sciences.

The science education programs continued to provide outstanding service as evidenced by a September 10, 2001 memo from DOE-SC which stated in part that "During this fiscal year, PNNL's Science Education group has continued to demonstrate their outstanding and unparalleled management of the three undergraduate programs funded by the Office of Science-Energy Research Undergraduate Laboratory Fellowship, Community College Institute, and Pre-Service Teacher Programs." Finally, the Laboratory continues to increase the depth of our partnerships through the formation of Joint Research Institutes.

Based on the evidence provided in this self-evaluation, our overall performance rating on this critical outcome is **Outstanding**.

### Operational Excellence

Pacific Northwest National Laboratory continues to conduct work and operate facilities with distinction and in a manner that is fully supportive of the Laboratory's science and technology mission. We have made significant investments over the past eight years to integrate sound safety and environmental management practices into daily operations. These investments are now paying off in lower accident rates for staff.

In acknowledgement of our commitment to protecting the health and safety of our staff, PNNL

was recognized as a DOE Voluntary Protection Program (VPP) Gold Star site during FY2001. In addition, we received the VPP Superior Star Award. This award, established by DOE to recognize superior performance in health and safety, acknowledges sites that demonstrate strong performance and strong involvement in VPP mentoring and outreach.

Our laboratory is committed to providing high quality science and technology at a competitive cost. By focusing on continued cost improvement and establishing business indicators in our performance agreement with the DOE, we are improving our cost performance while at the same time delivering high quality science and technology to our customers.

In the arena of Safeguards and Security (S&S), we have continued to institutionalize the Integrated Safeguards and Security management system. These efforts have resulted in increased numbers of staff with current S&S training, receiving highest possible marks in three external S&S system evaluations, and a reduction in reportable security incidents from eight in FY1999, to four in FY2000, and to one in FY2001.

We have made significant progress in enhancing the internal processes necessary to understand current and future mission needs. These efforts have resulted in an increased ability to hire or develop the needed staff, as well as to acquire facilities and equipment capabilities necessary to support those staff at accomplishing the Lab's missions.

Execution of the Facilities Strategic Plan during FY2001 resulted in continued progress toward the infrastructure needs to achieve the Laboratory's vision for the 21<sup>st</sup> Century. We activated the Local Area Island (LAI) in EESB during the second quarter and we completed construction of the User Housing Facility on schedule. In addition, we have worked to revitalize existing facilities while working to make the 21<sup>st</sup> Century Campus of the Future a reality. Issues that will require our attention in FY2002 include increasing occupancy rates at the new User Housing Facility and managing the limited office space available for our research staff.

In support of our continuing efforts to streamline and improve the operational aspects of how the Laboratory delivers products and services to its customers, we assessed the maturity of each of our current management systems. Overall, our management systems are “Basically Effective.” We received high marks in the design of the systems but have some holes in implementation. We will address these issues in FY2002.

Based on our performance against the objectives that support this Critical Outcome we believe our performance rating is **Outstanding**.

### Leadership and Management

Battelle staff, leaders and managers are making a difference within the DOE Complex, the Pacific Northwest and the community. We are helping create a diversified regional economy by putting technology to work in the Tri-Cities region. In FY2001 we launched, or helped launch, eight new businesses, bringing our five-year total to 50, and we provided technical assistance to 43 additional businesses. Fully 100 percent of the technical assistance recipients surveyed indicated that they were satisfied or better with the assistance provided and with the interaction process, providing solid feedback that our technical assistance program is delivering what the customer needs.

We have worked with Other Hanford Contractors and other regional entities such as TRIDEC and the Alliance of Angels/Technology Alliance, to help diversify the local economy. We took an active role in TRIDEC's efforts to develop an economic development strategic plan. We developed a significant relationship with the Biotechnology Association of the Spokane Region, and we have assisted the Tri-Cities Venture Group to grow, filling a significant need within the community. In addition, we developed and championed a number of new economic development initiatives.

We are seeking the best scientific and engineering minds available and are bringing them to the Lab to join our pursuit of scientific and technological excellence. We identified 14 strategic positions in FY2001 and filled 12 of those positions. Fifty percent of the positions were filled with internal candidates through our succession planning process and 50 percent were filled from outside the Lab. Thirty-three percent (33%) of the positions were filled by women and eight percent (8%) were filled by minority candidates.

Once new staff get here, our Invitation to Excellence program exposes them to a wide-range of topics ensuring that new staff and managers integrate into the Laboratory faster, thus increasing staff commitment, understanding of the Lab and its programs, and productivity during the first year. In FY2001, nearly 300 staff participated in 26 sessions of this program.

Based upon our progress toward the Objectives that support this Critical Outcome, we believe our FY2001 performance rating is **Outstanding**.

### Strengths and Areas for Improvement

Our integrated planning and assessment process results in the identification of Laboratory strengths and opportunities for improvement. While our FY2001 performance was exceptionally strong, areas for improvement have been identified and are highlighted. The areas for improvement identified align well with our five strategic objectives for FY2002 and beyond, which are highlighted below.

- ◆ Scientific and Technological Excellence
- ◆ Outstanding Managers and Staff
- ◆ Leaders in Research Management and Operations
- ◆ Highly Beneficial Deployments
- ◆ Valued Regional and Community Asset



Although we have strengths supporting the objectives above, we have also identified a number of areas that require our focused attention if we are to sustain a high level of performance. A detailed discussion of our strengths and areas for improvement can be found in Part II of this report.

## Self-Assessment Program Maturity

The results of our self-assessment process feed directly into our Critical Outcomes and the identification of strengths and areas for improvement. Self-assessment is the backbone of our performance-based approach to managing the Laboratory. For this reason we believe it is important to continually evaluate the overall maturity of this critical process. Results indicate that our self-assessment program is generally effective and capable of identifying issues that warrant our attention. Self-assessment issues that require continued attention include improving our trending and analysis capabilities and the use of activity-based assessments as a tool to help us better understand how well key in-process controls are working. Additional detail is provided in Part III of this report.

## Partnering for Success

PNNL's success hinges on a strong partnership with DOE. Noteworthy examples include:

- ♦ Assistance from RL and AMT in making changes to our Labor Charging Process to create a more flexible system that responds to recent changes in Washington State labor law
- ♦ Strong teaming with RL and AMT on the Compensation Program recertification
- ♦ Assistance from RL in facilitating the approval of recruiting and retention tools
- ♦ AMT advocacy and assistance in helping make our vision of the User Housing Facility become a reality
- ♦ Assistance from AMT with both local and headquarters DOE elements in planning and executing the transfer of 24 excess facilities
- ♦ AMF's advocacy for the disposal of PNNL Low Enriched Uranium waste

# Contents

Executive Summary .....	iii
Introduction .....	xi
PART I Status of Performance Against the Critical Outcomes .....	1
1.0 Scientific & Technological Excellence .....	3
<b>Science Mission—Office of Science (DOE-SC)</b> .....	4
1.1 Quality of Science and Technology .....	4
1.2 Relevance to DOE R&D Portfolios and National Needs .....	10
1.3 Success in Constructing and Operating Research Facilities .....	12
1.4 Effectiveness and Efficiency of Research Program Management .....	16
<b>Environmental Quality Mission—Office of Environmental Management (DOE-EM)</b> .....	18
1.1 Quality of Science and Technology .....	18
1.2 Relevance to Mission .....	21
1.4 Effectiveness and Efficiency of Research Program Management .....	25
<b>National Security Mission—Office of Nonproliferation and National Security (DOE-NN)</b> ..	30
<b>Office of Intelligence (DOE-IN)</b> .....	34
1.1 Quality of Science and Technology .....	34
1.2 Relevance to DOE Mission and National Needs .....	36
1.4 Effectiveness and Efficiency of Research Program Management .....	36
<b>Office of Counterintelligence (DOE-CN)</b> .....	36
1.1 Quality of Science and Technology .....	37
1.2 Relevance to DOE Mission and National Needs .....	37
1.4 Effectiveness and Efficiency of Research Program Management .....	38
<b>Energy Mission</b> .....	38
<b>Office of Fossil Energy (DOE-FE)</b> .....	41
1.1 Quality of Science and Technology and Effective Program Management .....	41
1.2 Relevance to DOE Mission and National Needs and Effective Program Management .....	42
<b>Office of Energy Efficiency and Renewable Energy (DOE-EE/RE)</b> .....	44
1.1 Quality of Science and Technology and Effective Program Management .....	44
1.2 Relevance to DOE Mission and National Needs and Effective Program Management .....	45
<b>Major Laboratory Initiatives</b> .....	47
1.5 Create Leading-Edge Scientific Capabilities to Support Evolving DOE Mission Needs .....	46
<b>Academic Partnerships and Science Education</b> .....	54
1.6 Create and Maintain Strategic Academic Partnership That Strengthen Scientific Capabilities and Demonstrate Leadership in Educating Future Scientists .....	54



2.0 Management and Operational Excellence .....	59
2.1 Provide Management and Operational Excellence in Achieving Key Contract Provisions .....	60
2.2 Optimize Capability Alignment with Current and Future Missions Needs .....	69
2.3 Provide an Integrated Management System That Enables PNNL Mission Execution While Providing Stewardship of DOE Assets .....	71
3.0 Leadership Excellence .....	77
3.1 Help Define and Shape the Future of the Region by Working to Establish a Robust, Sustainable, Regional Economy .....	78
3.2 Attract, Develop and Retain the Critical Staff Necessary to Achieve Simultaneous Excellence in S&T, Operations, and Community Trust.....	82
4.0 Determining the Laboratory's FY2001 Performance Rating.....	85
PART II Summary of Laboratory Strengths and Areas for Improvement for FY2001 .....	87
1. Scientific and Technological Excellence .....	91
2. Outstanding Managers and Staff .....	92
3. Leaders in Research Management and Operations .....	93
4. Highly Beneficial Deployments .....	99
5. Valued Regional and Community Asset .....	100
PART III Assessment of PNNL Self-Assessment Program Maturity .....	101
Overview .....	103
Background .....	103
The Process Underlying Self-Assessment .....	103
Overall Assessment .....	105
Operational Awareness .....	108
Summary of Progress Made Against Key Self-Assessment Improvement Themes .....	109
Appendix A Results of Peer Review .....	111
Appendix B Summary of Operational Improvement Initiatives for FY2001.....	135
Appendix C DOE-RL's Satisfaction with the Implementation of Self-Assessment Processes at PNNL in FY2001 .....	145
Appendix D Acronyms .....	151

## Introduction

The Laboratory's goal for the FY2001 Self-Evaluation is to provide a critical review of our progress toward accomplishing the Critical Outcomes and previously identified areas for improvement, and to evaluate the maturity of our Self-Assessment Program. The Laboratory uses self-assessment to drive continuous improvement.

In addition to providing an assessment of our performance against the FY2001 Critical Outcomes, objectives, measures and expectations, DOE O 224.1, Performance-Based Business Management Oversight Process, requires that we provide the Department of Energy with a description of how key in-process requirements are being met, including compliance with applicable DOE and Federal requirements, compliance with key internal controls, and the degree to which those key requirements and internal controls have been met. In addition, DOE O 224.1 requires that we identify improvement opportunities and improvement plans.

Part I of this report presents the results and analysis of progress made against the key outcomes and expectations important to the Lab and DOE. Part II presents a detailed analysis of our strengths and areas for improvement, as derived from the results of Parts I and III. Part II also provides a discussion of how the identification of improvement opportunities leads to the development of improvement plans at several levels: organizationally, at the management system level, and at the Operational Improvement Initiative level.

Part III of this report provides an analysis of the progress we are making in maturing our self-assessment program. Included in this section is a discussion of how key in-process requirements are being met, including how the Laboratory determines compliance with applicable DOE and Federal requirements and key internal controls, and the degree to which those key requirements and internal controls have been met.

Building upon the framework established in FY1996, and improved upon each year since, this year's Self-Evaluation Report presents a focused, quantitative and objective approach to evaluating the performance of the Laboratory. It is based on the Laboratory's performance toward achieving a set of Critical Outcomes, objectives and performance indicators that were developed in partnership with our key customers, and codified in the FY2001 Performance Evaluation and Fee Agreement, Modification M328.

To ensure our long-term ability to provide high-value products and services to our U.S. Department of Energy (DOE) customer, the Laboratory, in partnership with our DOE customer, evaluated both its long-term needs and the current operating environment to develop the set of Critical Outcomes. The Laboratory's FY2001 Critical Outcomes serve as a basis for the overall management and measurement of performance within the Laboratory. Each outcome is supported by two or more objectives. Progress toward each objective is measured by performance against a specific set of performance indicators. The results of progress toward the Critical Outcomes as documented in Part I of this report are also used to provide DOE-RL with a measurement system by which annual Laboratory performance can be evaluated.

The Laboratory's FY2001 performance rating can be determined by evaluating progress against agreed-to individual performance indicators and rolling the results up to the Objective, Critical Outcome, and Laboratory levels.

The Laboratory views self-assessment as the mechanism to determine if organizational and personal objectives are being accomplished and in the manner expected. Self-assessment has always been part of the Laboratory's management approach. However, determining where our Strengths lie, continuously identifying and acting

upon Areas for Improvement, and continually maturing our self-assessment process are the keys to sustaining and improving the overall performance of the Laboratory. Each Division and Directorate is required to perform an annual self-assessment and to document the results of that assessment. A summary of the Laboratory-level Strengths and Areas for Improvement,

gleaned from the Division's and Directorate's self-assessment reports, and other associated performance reports, is provided as Part II of this document.

Part III of this report provides a summary Assessment of the PNNL Self-Assessment Program Maturity evaluation.



# **Part I**

**Status of Performance  
Against the Critical Outcomes**

## 1.0 Scientific & Technological Excellence

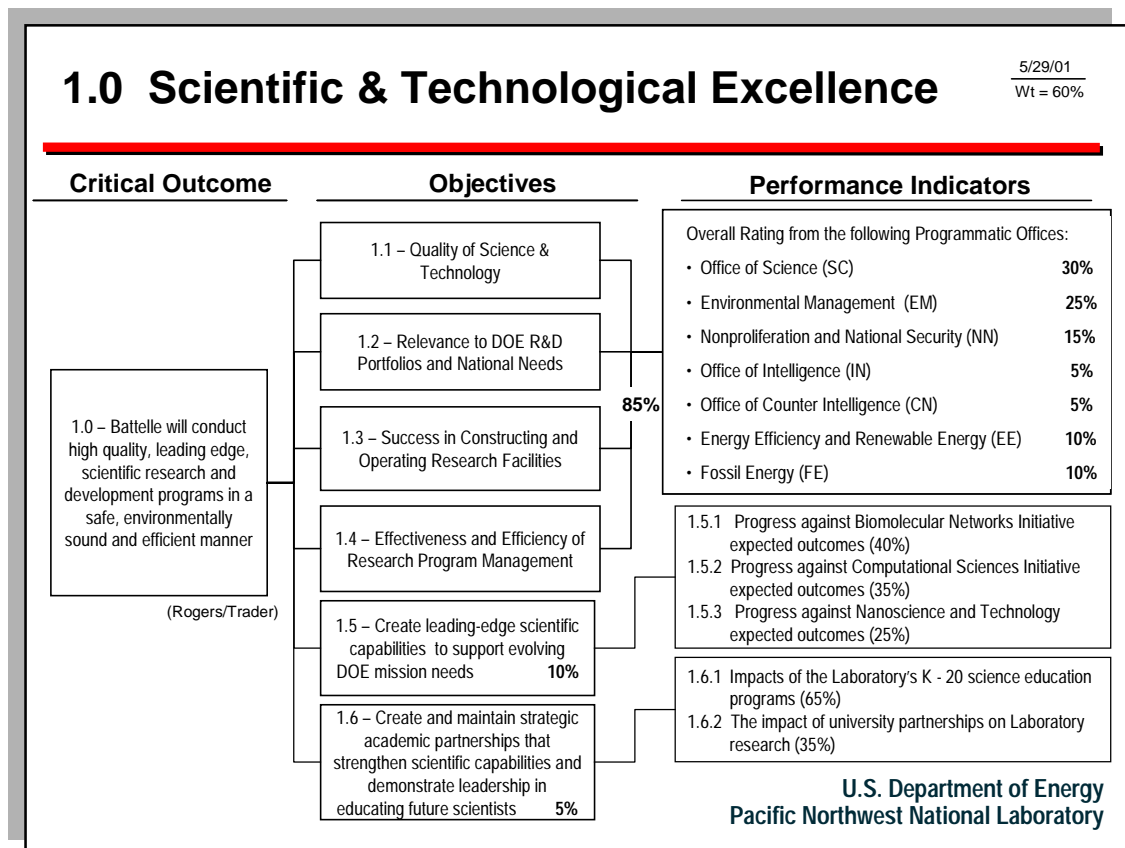
Pacific Northwest National Laboratory intends to be a premier scientific institution, conducting research at the interfaces of the physical, life, and information sciences and technology; known for solving the U.S. Department of Energy's (DOE) most critical and challenging problems, widely recognized for operational excellence, and highly valued by the community and region in which it operates.

We continue to strengthen the scientific core of the Laboratory, improving both the quality and scientific impact of our basic research programs and strengthening their ties to outcomes important to DOE, Congress, and the public.

Placing an emphasis on partnerships for scientific research and education, we continue to increase the fraction of our research that is carried out in partnership with leading universities, and provide research participation opportunities to visiting students.

Finally, we manage and operate our research and user facilities, as well as our research programs, with distinction.

For these reasons, and in partnership with DOE, the Laboratory has established the Scientific & Technological Excellence Critical Outcome, objectives and performance indicators, presented below, to guide its efforts and to monitor progress.



## Summary

The Laboratory is conducting high-quality and highly relevant science and technology programs that are providing new insights and solutions to key technical issues facing the nation and the world. Customers consistently rate our performance high indicating that we are delivering value. Peer reviews of major programs recognize our work as achieving national and international recognition for excellence in experimental research, for the breadth of our research programs, and as having staff and facilities of the highest caliber. The relevance of our work to DOE missions and national needs is further indicated by our strong performance in capturing new programs and critical proposals for new work.

Formal recognition received from external sources provides further evidence of our impact. The Laboratory received external recognition for our work in FY2001 including four Research and Development (R&D) 100 awards, two Discover Magazine awards, and four Federal Laboratory Consortium (FLC) awards. In addition, the quality and relevance of our scientific efforts are reflected by the breadth of staff that were recognized for their scientific and engineering excellence in terms of awards, invited talks, and participation on scientific committees. Our publication rate remained stable in FY2001 and appears to be in line with other national laboratories when we also consider funding and scientist and engineer staffing comparisons. FY2002 will see renewed attention on this indicator and the factors influencing publication growth so we can better influence growth.

The Laboratory validated its leadership role by conducting interviews with key DOE programmatic personnel. These interviews indicate that our customers have a high degree of confidence in our leadership.

While sustaining a high level of performance in our key missions, we also made strong and substantive progress across our three key initiatives.

We continue to increase the breadth and depth of our academic partnerships. These enable the flow of new ideas, as well as high quality science and engineering staff into the laboratory, thus contributing to our continued success.

Mission specific accomplishments are summarized at the beginning of each mission area discussion. Based on the evidence provided in this self-evaluation, our overall performance rating on this critical outcome is **Outstanding**.

## Science Mission

Many of the indicators we use to determine our level of performance and predict how our customer will view our performance transcend one or more of the four key objectives identified in the Performance Evaluation and Fee Agreement. It is important to note that no one section can stand alone.

### Office of Science (DOE-SC)

The continued progress noted by peer reviews, our sustained recognition and publication performance, and our academic/scientific partnerships reflect the overall quality and relevance of our science. Results indicate that we are positioned to capture new market opportunities or are already beginning to do so in our science mission, consistent with our strategy. We continue to demonstrate strong stewardship for the EMSL user facility, for the day-to-day operation of ARM, and we are gaining momentum in the carbon sequestration research consortium in which we are a collaborative partner. We continue to enhance G-1 Aircraft operations. We believe we are conducting research in areas important to DOE and are effectively and actively managing those programs entrusted to us.

Based on the objectives and supporting indicators that support this outcome, we believe our FY2001 rating is **Outstanding**.

### 1.1 Quality of Science and Technology

#### Results

Peer reviews continue to represent one of the most profound indications of the caliber of our scientific and technological performance. Peer review underpins all aspects of our science and technology including Division reviews, DOE program reviews, LDRD and proposal reviews, and peer reviews of important publications. Results from our peer

review endeavors indicate that we have staff and facilities of the highest caliber, that our work is recognized nationally and internationally, and that we are contributing to issues important to the nation. The relevance of our work is further indicated by our outstanding success rate in capturing new programs and critical proposals for new work such as the Microbial Genome Program and Scientific Discovery through Advanced Computing. Progress is further supported by the diverse recognition that we sustain at the state, regional, national and international levels. Furthermore, our sustained performance in R&D100 and FLC competitions indicate that we continue to be effective in the development and transfer of relevant technology. Our scientific publication rate, an important mechanism for sharing new knowledge with the national and international community, is in line with previous years and we are better able to understand their impact. Finally, we continue to increase the breadth and depth of our academic partnerships. These enable the flow of new ideas, as well as high quality science and engineering staff into the laboratory, thus contributing to our continued success.

Based upon the performance indicators that support our objectives of delivering high quality and highly relevant science and technology, our rating for FY2001 is **Outstanding**.

## Analysis

**Results of Peer Reviews:** The following are the primary components of the Laboratory's peer review process:

- ♦ The Laboratory Review Committee (LRC) is composed of chairs of the Division Review Committees (DRCs). This committee reports to the Laboratory Director.
- ♦ The Division Review Committees (DRCs) ensure proper peer review of major programs/projects, product lines, core technical capabilities, and technologies. The reviews cover Division activities on a three-year rotating basis so that all work is reviewed at least once every three years.
- ♦ External Reviews are performed on specific PNNL research programs and proposals.

The summary results of these reviews, across all mission areas, are provided in Appendix A. Fundamental Science Division-specific results are highlighted here.

## LRC Review

During the LRC meeting, LRC members shared a number of remarks regarding the Laboratory's overall value and character that speak directly to the high quality of research at PNNL. Dr. Hochella said that "of the three national laboratories he knows well, PNNL is the only one in which he has not seen deadwood. This laboratory has more of a tough research university feel than any other he knows. Scientists here feel the intense pressure to produce just like their academic colleagues struggling to get tenure and programmatic support; and that's the way it should be."

In related remarks Dr. Berkey reiterated the "no deadwood" comment and said that PNNL staff members don't expect entitlement (citing as an example our vetting process on major RFPs), and they are accustomed to competing. He also noted that the Laboratory's successes in responding to RFPs are well known externally and urges the Laboratory to maintain its vetting process that selects only the best proposals for communication to funding agencies. He concluded by noting that "more than other national laboratories in his experience," the focus here is on high quality from staff members up to management.

With respect to the Fundamental Science Division, each major point of the DRC report was described to the LRC in detail. It was stated that rankings of outstanding and excellent were not reflections of grade inflation. The most important Division task is to "firmly establish the direction and find strong leadership for the biological sciences that will allow the Biomolecular Networks Initiative to flourish". BNI will make the laboratory "truly unique". Details are found in Appendix A.

## DRC Review

*Review Scope:* The review was held May 9-10, 2001. Components of the review included the Biomolecular Networks Initiative (BNI), computational science/engineering, Joint Global Change



Research Institute, environmental chemistry and microbiology, and molecular biosciences/toxicology, and the EMSL Collaboratory.

**General Comments:** Environmental chemistry and microbiology were rated outstanding, and the Joint Global Change Research Institute was rated excellent/potential to be outstanding. Computational sciences and engineering, molecular biosciences/toxicology, and the EMSL Collaboratory were all rated excellent. The DRC felt the BNI had an emerging program that it was too premature to rate it. Specific comments are found in Appendix A.

## External Program and Proposal Peer Reviews

### *Chemical Physics Program*

The review of the Molecular Theory and Modeling programs was held on March 5-6, 2001. The review summary stated “This is a fine program fueled by a team of enthusiastic investigators with lots of ideas and energy” and “is distinguished by collaborations among the group and with the external scientific community.” PNNL “should take great pride in an excellent program that maintains both high scientific quality and relevance to the DOE mission.” The committee also noted the problems caused by diminished technical support from flat budgets over the past several years. Additional details are found in Appendix A.

### *Materials Science Program*

The review was held June 13-14, 2001. It was noted that the fact that Lura Powell gave the introduction was “impressive and surprising” and indicated “the importance of this basic program to the upper laboratory management.” It was noted that the program forms an important part of DOE basic research and that PNNL is helping DOE in a number of ways in addition to the projects themselves. The reviewers felt that, in general the budgets for the work don’t appear to be adequate but noted that “progress is remarkable.”

### *Proposal Reviews*

During FY2001 PNNL customers showed their confidence in the quality of PNNL’s research

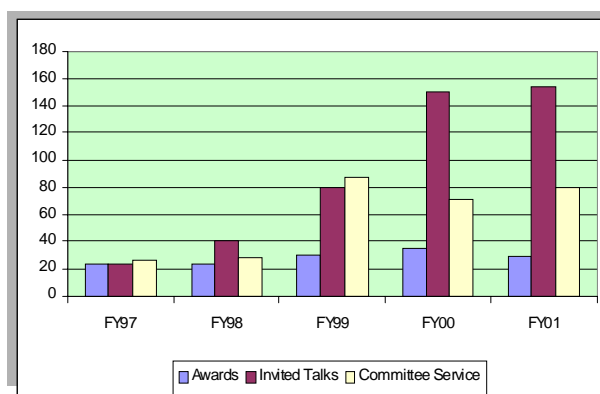
through the success of its proposals. Of particular note were:

- ♦ Natural and Accelerated Bioremediation (NABIR). PNNL won six of eight proposals submitted continuing its position as the largest NABIR-sponsored institution.
- ♦ Microbial Genome Program. PNNL was funded for its first two genome proposals culminating several years effort to gain credibility in this research area.
- ♦ Low Dose Radiation Research Program. PNNL succeeded with two of four proposals submitted.
- ♦ Scientific Discovery Through Advanced Computing. As a result of success on 10 proposals on 14 proposal teams, PNNL now is involved in an array of the most important computing projects in DOE/SC, in collaboration with other leading scientists at DOE laboratories and universities across the nation.

Additional details are found in Appendix A.

## Recognition by the Scientific Community:

Recognition of our staff contributions in the state, regional, national and international communities is evaluated across the three key dimensions of awards, invited talks, and committee service. The total number of awards, invited talks and committee service rose from 196 in FY1999 to 257 in FY2000 and is up to 263 in FY2001. While the total numbers of awards decreased slightly from FY2000 to FY2001, this year’s awards were particularly noteworthy. Among them were Discover Magazine awards for land mine detection and combined optical and NMR microscopy. These awards in particular illustrate how very relevant PNNL’s research is to both DOE and the nation. In addition we sustained both our R&D 100 and FLC award rate. Some of the invited talks were also particularly prestigious this year. James Edmonds’ presentation before the President’s Cabinet and U.S. Senate committees shows the high level of recognition that PNNL has achieved in Climate Change research. The number of staff serving on committees in FY2001 increased to 80 from 52 in FY2000, reflecting PNNL increasing commitment to service in their professional fields. Figure 1.1



**Figure 1.1.** Historic Measures of PNNL Scientific Recognition

provides a breakdown of the categories of recognition by fiscal year.

Highlights of our performance are presented below:

**Awards:** Twenty-nine PNNL staff members received individual international, national, state, or regional awards.

- ♦ Five staff members were named Fellows: **Debrah Dickman**, Institute of Nuclear Materials Management; **Michael Newman**, American Physical Society; **Donald Baer**, American Vacuum Society; **Greg Piepel**, American Statistical Association; **Bruce Kay**, American Physical Society.
- ♦ **Mary Zalesny**, was awarded a diplomatic fellowship with the American Association for the Advancement of Science.
- ♦ **Tom Tenforde** received the d'Arsonval award for lifetime achievement in the field of bioelectromagnetics in the Bioelectromagnetics Society.
- ♦ **Richard Craig** received the 2001 Discover Magazine Innovation Award for the development of the Timed Neutron Detector for landmine detection.
- ♦ **Dr. T. Edmond Hui** has joined the ranks of PNNL health physics professionals who have received the coveted Elda E. Anderson Award from the Health Physics Society. The Anderson award is one of the highest awards given by the Health Physics Society, which has approximately 6,000 members in more than 40 countries.

- ♦ **Robert Wind** received the 2001 Discover Magazine Technology Award in the Health Category for leading the team that developed the combined optical and magnetic resonance microscope.
- ♦ **Lane Bray** received the ANS International Award for his work in medical isotopes.
- ♦ **Richard Smith** and **Harold Udseth** received the Energy 100 Award. The award was created this year to honor 100 of the best scientific and technological accomplishments of the DOE during the 20<sup>th</sup> Century.

**Invited Talks:** 154 invited talks that qualified under this indicator were given by 95 staff members:

- ♦ **James Edmonds** gave a briefing on climate change to the Cabinet of the President of the United States; Secretaries of State, Interior, Treasury, and Commerce; Chairman of the President's Council of Economic Advisors; and others on May 1, 2001.
- ♦ **James Edmonds** gave testimony in May, June, and July before various Senate committees on greenhouse gases.
- ♦ **George Mellinger** presented *Waste Glass Processing Requirements of the Hanford Tank Waste Treatment Immobilization Plant* at the 103<sup>rd</sup> Annual Meeting of the American Ceramic Society in August 2001.
- ♦ **James Fuller** presented *Debt-for-Nonproliferation* at the International Nuclear Materials Policy Forum in Washington, D.C. on Sept. 28, 2001.

**Committee Service:** 80 staff members are currently serving on science related committees. Particularly noteworthy positions include the following:

- ♦ **David Koppelaar**. Editorial Board Member of the Journal of Analytical Atomic Spectroscopy.
- ♦ **Larry Morgan**. Defense Science Board Task Force on Intelligence Needs for Homeland Defense.
- ♦ **Kristin Jarman**. Member, Editorial Advisory Board of the Chemometrics and Intelligent Laboratory Systems. (10/01/2001-present)

- ♦ **Donald Baer.** Co-chair for the 198<sup>th</sup> Electrochemical Society Meeting in Phoenix, AZ on October 23, 2000.
- ♦ **Stephan Mladineo.** Chairman, Arms Control & Nonproliferation Technical Division Institute of Nuclear Materials Management. (10/1/2000-09/30/2001).

**Number of R&D 100 and FLC Awards:** This indicator helps us understand our strength in developing and transferring relevant technologies that are valued by the technical community. In FY2001, the Laboratory won a total of eight R&D 100 and FLC awards. We won four out of eight entries submitted to R&D Magazine's Awards for the Top 100 Technologically Significant Processes and Products for 2001. In addition, PNNL staff won four out of four entries submitted for the 2001 FLC Awards for Excellence in Technology Transfer.

#### *R&D 100 Awards*

- ♦ MilliWave Viscometer
- ♦ Long-Range Semi-Passive Radio Frequency Identification System

- ♦ Decision Support for Operations and Maintenance
- ♦ Catalyst Materials for Plasma-Catalysis Engine Exhaust Treatment

#### *Federal laboratory Consortium (FLC) Awards*

- ♦ Radionuclide Detection Technologies
- ♦ EMSL Publisher Software
- ♦ Multi-Blade Knife Failure Detector
- ♦ Yttrium-90 for Cancer Treatment

PNNL continues to demonstrate its sustained science and technological excellence in these competitions as evidenced from the results in Table 1.1.

**Publication Growth:** Publication of research results in the open literature is an indicator of scientific productivity and quality, as well as external recognition. Publications represent a significant mechanism by which our science reaches the national and international community. In order to assess our performance we utilize the research

**Table 1.1.** R&D 100 and Federal Laboratory Consortium Awards by National Laboratory

National Laboratory	R&D Awards (1964-2001) (ranking in parentheses)	FLC Awards (1984-2001) (ranking in parenthesis)
<b>Multiprogram Laboratories</b>		
Argonne	61 (4)	20 (4)
Brookhaven	22 (9)	10 (7)
Idaho	27 (8)	8 (9)
Lawrence Berkeley	31 (7)	16 (5)
Lawrence Livermore	80 (2)	26 (3)
Los Alamos	78 (3)	13 (6)
Oak Ridge	109 (1)	28 (2)
<b>Pacific Northwest</b>	<b>58 (5)</b>	<b>48 (1)</b>
Sandia	52 (6)	10 (7)
<b>Single-Program Laboratories</b>		
Ames	15 (10)	16 (5)
Fermi	13 (11)	1 (10)
National Energy Tech Laboratory	2 (13)	9 (8)
NREL	31 (7)	9 (8)
PPPL	2 (13)	0 (11)
<b>Other Laboratories and Facilities</b>		
Hanford Site	3 (11)	0 (12)

services provided by ISI (Institute for Scientific Information). In FY2001, 548 publications qualified for inclusion under this indicator. This is 25 less than last year but slightly higher than the three year rolling average. Results are presented in Figure 1.2.

The diversity of our contributions in the open literature can be seen in Table 1.2. This table presents those journals where PNNL published five or more articles in FY2001. A comparison to FY1998-FY2001 results is also provided.

One method of judging the quality of journals is to look at the impact factor of each journal. This ranking, developed by ISI, is calculated by dividing the number of current citations to articles published in the previous two years by the total number of articles published in the previous two years. In FY2001, PNNL published in 234 different publications. Of these titles, 83 or 35% have an impact factor putting them in the top ten for their subject areas. This number is up slightly from FY2000.

Fifty (50) titles have no impact factor because they are either conference proceedings or too new.

While the data in Table 1.2 are too sparse to formally identify trends review of the results in Figure 1.2 indicates that from FY1996 through FY2001 the total number of publications has not changed significantly. In the past two years the impact factor also has risen only slightly. We have conducted several high-level comparisons with other National laboratories. Those comparisons included publication rate changes over time normalized to R&D and mission funding profiles. We also considered S&E staffing levels. The results indicate that our publication rate is strong for the dollars invested. However, only very high-level data was available which limited the analysis somewhat. In FY2002 we will place emphasis on how to best understand this important productivity metric so that we can get more accurate data, and can then better influence achieving our desired outcome of continued growth.

**Table 1.2.** Comparison of Selected Peer-Reviewed Publications in which PNNL Staff Publish.

Publication Titles with More Than 5 PNNL Authored Papers, sorted by FY2000				
Journal Title	FY1998	FY1999	FY2000	FY2001
Journal of Nuclear Materials	13	41	8	45
Journal of Chemical Physics	22	29	33	26
Journal of Physical Chemistry A	17	17	27	23
Analytical Chemistry	12	11	16	18
Environmental Science and Technology	1	3	11	15
Journal of Physical Chemistry B	13	8	10	15
Journal of Radioanalytical and Nuclear Chemistry		12	2	14
Journal of Americal Chemical Society	12	12	17	10
Physical Review B	6	3	7	10
Journal or Geographic Research	6	1	10	9
Geochimica et Cosmochimica Acta	3	3	3	7
Applied and Environmental Microbiology	2	1	5	6
Health Physics	1	3	8	6
Inorganic Chemistry	3	3	4	6
International Journal of Mass Spectrometry	4	2	3	6
Journal of Vacuum Science and Technology A	4	7	4	6
Nuclear Instruments and Methods in Physics Research B	6	4	9	5

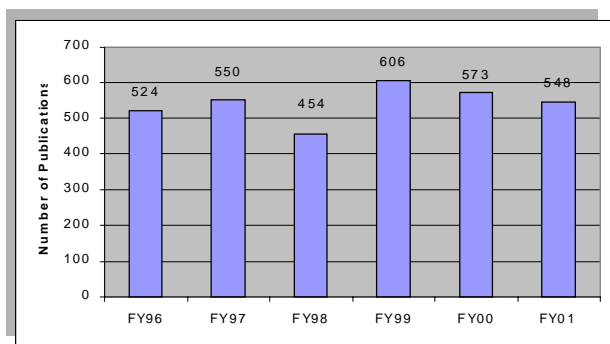


Figure 1.2. PNNL Publications in Peer-Reviewed Journals

## 1.2 Relevance to DOE R&D Portfolios and National Needs

### Results

The Laboratory is clearly relevant to DOE R&D Portfolios and national needs in science and health. Examples of relevance are found throughout this document. In Objective 1.1, Peer and Program reviews are summarized that focus attention on *both* the quality and relevance of the research. The quality and relevance of our science is highlighted through the numerous and diverse awards we receive, the publications we produce, the fact that we are invited to speak in numerous forums, and that we are asked to serve on important committees. When Robert Wind received the 2001 Discover Magazine Technology Innovation Award for inventing a combined optical and magnetic resonance microscope this year, OBER demonstrated recognition of the research's relevance by allocating \$750K capital equipment for another dedicated NMR spectrometer. We truly contribute to important DOE R&D and national needs. Success in proposals highlights the confidence of our DOE customers in both the quality and relevance of our proposed research. Objective 1.5 focuses on the initiatives that the Laboratory has undertaken to build its capabilities to meet our 2010 Vision which fully supports DOE and the nation's future research needs in Biological, Computational, and Nanoscience science and technology. The relevance of these efforts is evident from the fact that they are supported, in varying degrees, by our DOE customer and reflect broad collaborative efforts with other National laboratories, academia and industry. Objective 1.6 focuses on development of

future scientists and engineers as well as collaboration with universities to expand the Laboratory's capabilities to do the research that DOE and the nation need now and are expected to need in future. Nothing could be more relevant to the R&D Portfolio and national research needs. Based upon our results, we believe our performance is **Outstanding**.

### Analysis

PNNL performs fundamental research in a wide variety of areas that support the DOE mission and national needs. Three areas are highlighted in the succeeding sections.

### Materials Science

Scientists at PNNL have made major contributions to a fundamental understanding of nanostructural materials, biomimetic processes, the chemistry and physics of ceramic surfaces, irradiation effects in solids, phase transformations, defect processes in ceramics, optical films, stress corrosion, and deformation processes. Our research has developed new bioceramic coatings that can coat both highly porous and smooth surfaces and have demonstrated applications for orthopedic implants. We have developed a mesoporous ceramic material with high catalytic efficiency and enzyme-like properties. Almost all biological chemical reactions and energy conversions are catalyzed by enzymes. Organic functional groups attach to the pore channels in a ceramic material to produce enzyme-like activity. Thermally sensitive polymers allow the pores to open or close as in a real enzyme. The resulting "nanofactories" are leading the way to a new generation of intelligent materials that mimic sophisticated biological functions, which may be used to create separations techniques for waste.

The Laboratory's fundamental research on irradiation-induced phase transformations has led to the discovery of a radiation resistant material, gadolinium zirconate, that is far superior to the current materials proposed for plutonium immobilization. Current materials are sensitive to radiation-induced degradation that enhances plutonium release to the environment. This fundamental research can significantly change the way future generations are protected from this highly toxic material.



Unique capabilities and instrumentation exist in the Laboratory to build structures one atom layer at a time and to determine atomic and molecular structure on the nanoscale, across and through interfaces, and in bulk materials.

An example of research results with relevance particularly to advanced computing is Scott Chambers' work in molecular beam epitaxy. This research is an excellent example of nanoscience research catalyzed by the Nanoscience and Nanotechnology Initiative using LDRD funding. Chambers' team has devised semiconductor material that has superior magnetic properties at room temperature. Until now, impractical cooling techniques would be required to maintain the magnetic properties of semiconductor material. Molecular beam epitaxy is used to generate individual beams of atoms, in this case titanium, oxygen, and cobalt, in a highly controlled vacuum and direct them onto a crystalline surface of strontium titanate, where the atoms condense and form a crystalline film with dimensions on the nanoscale. Quantum computers store data as a series of quantum states, such as the spin directions of an electron. By controlling the spin within this semiconductor material, researchers hope to greatly increase computational speeds and data storage over conventional silicon-based computer technologies.

### **Health Effects and Life Sciences**

Understanding the molecular basis of toxic effects of chemicals and radiation on health and disease is critical to DOE's missions in Science, Environmental Quality, Energy Resources, and National Security. PNNL does research in radiation biology that is the basis for national and international worker protection standards. Life sciences research at the Laboratory takes advantage of modern tools of molecular cell biology and integrates them with leading-edge instrumental and computational capabilities in EMSL to advance fundamental understanding of DNA damage and repair, the cell cycle, and molecular structure-function as these relate to chronic low dose exposure to chemicals and radiation, and other issues in environmental health. We use advanced instrumentation to detect the detailed chemical nature of DNA damage from exposure to ionizing radiation and to study radiation-induced cancer.

An example of a PNNL discovery with highly relevant application to DOE is Single-Molecule Spectroscopy recently recognized by DOE as one of the 101 most important discoveries in the past 2-1/2 decades. Real-time observation of individual enzyme molecules by Peter Lu (PNNL) and Sunney Xie (Harvard University) established single-molecule spectroscopy as one of the most important new methods for unraveling chemical dynamics in heterogeneous and complex chemical systems. Single-Molecule Spectroscopy revealed conformational dynamics of fluctuating noncovalent DNA-protein interactions in DNA damage recognition. The method provides information previously unobtainable by conventional ensemble-averaged experiments. These data will facilitate a molecule-level understanding for the dynamics and mechanisms of the damage-recognition process in DNA repair.

### **Geosciences and Biogeochemistry Research**

Pacific Northwest National Laboratory has long been recognized as an international leader in interdisciplinary studies of subsurface science research. Over the last 20 years, this research has led to a greater understanding of the diverse microbial communities that exist in deep subsurface systems, the discovery of novel extremophiles that live at high temperatures or can survive without any carbon or energy from the surface, the development of new tools and tracers for collecting uncontaminated cores, and the advancement of theoretical models that integrate biogeochemical processes in a subsurface transport environment. Today's research provides the basic scientific knowledge necessary to effectively use microorganisms and bioremediation technologies for restoring contaminated soils, sediments, and groundwater at DOE sites.

Vadose zone sediments above the water table contain a large proportion of the contaminant mass at DOE sites in the western U.S. and serve as a reservoir for continued contamination of ground water. Nitrate and Cr(VI) are common vadose zone co-contaminants at DOE sites. Researchers participating in the DOE-OBERR's Natural and Accelerated Bioremediation Research (NABIR) Program have investigated the ability to bioremediate these contaminants in the vadose zone, thereby preventing future contamination of ground water. In the

first study of chromium reduction in sediments below the subsoil under unsaturated conditions, Drs. Fred Brockman, Tom Kieft, and colleagues at Pacific Northwest National Laboratory and New Mexico Institute of Mining and Technology have shown that the mobile form of chromium, Cr(VI), is microbially reduced to the immobile Cr(III). In unsaturated batch experiments with Hanford Site sediment, Cr(VI) concentrations in pore water decreased by 66-87% over 35 days in the presence of nitrate and added dilute molasses.

These are only a few of the research areas that illustrate the relevance of PNNL's research. Similar examples could be given in Theoretical and Experimental Chemistry, Atmospheric Science, Computational Science, and many other areas.

### 1.3 Success in Constructing and Operating Research Facilities

#### Results

Productivity, in terms of publications and user satisfaction provide highly relevant data to enable our understanding of the contributions made by those user facilities, extended research facilities, and distributed research centers entrusted to us. Results indicate a sustained level of performance.

EMSL's users value the resources and capabilities provided. EMSL's productivity, measured by publications and peer review, indicates that scientists are impacting the nation at increasing levels. We expect those levels to continue to increase over the long-term. As ascertained from peer review comments, this facility is well managed and can have strong and enduring impacts on the nation's scientific agenda.

The effectiveness of Atmospheric Radiation Measurement (ARM) is also manifest in its productivity and user satisfaction results. ARM is sustaining increasing publication rates that continue to exceed our expectations. While the customer satisfaction survey is currently being revamped, the Science Team informally continues to rank the quality of services and products provided highly.

The G-1 Aircraft had a productive and safe research flying season. During this year we were

able to train two new copilots while staying within budget. Additionally, we are seeing promising progress from the newly formed Terrestrial Carbon Sequestration Center.

Based upon the performance indicators that support this objective, our rating for FY2001 is **Outstanding**.

#### Analysis

##### Environmental Molecular Sciences Laboratory

In order to understand our success in operating the William R. Wiley Environmental Molecular Sciences Laboratory (EMSL) we look at three performance indicators. The number of users provides us with information regarding our impact to the greater scientific community, publication growth provides us with insight into the productivity resulting from use of EMSL, and user satisfaction provides information on how effectively we manage and operate EMSL as judged by users. Information provided through peer reviews allows us to correlate our indicators with overall performance.

In FY2001 a new EMSL-scale user facility for 21<sup>st</sup> Century Biological Research was proposed. This proposed facility is strongly supportive of DOE's Genomes-to-Life Initiative and builds on the unique strengths of PNNL in microbiology and experimental and computational molecular science, especially those in EMSL. Key to the creation of this new user facility is growth in PNNL's biological research program. The required new program development is fueled by the Biomolecular Networks Initiative, the Laboratory's principal discretionary investment in the first decade of the 21<sup>st</sup> century. This bold vision was validated by numerous external individuals and all review and advisory panels. Feedback from the DOE-SC On-Site Review was positive. Indeed, PNNL was given lead responsibility nationally for the Microbial Cell Program, DOE-SC's inaugural effort in its Genomes to Life initiative. However, full commitment forward has yet to be obtained.

**Number of Users:** For EMSL to be successful it must attract users that reflect a broad and diverse user base. The number of EMSL users has grown from 1231 in FY2000 to 1415 in FY2001.



Figure 1.3 shows that this represents a broad spectrum of participants, with the largest number from the academic community. This represents significant growth in the number of users.

**Publications:** An indicator of relevance and impact of the EMSL is the number of publications that are produced using the EMSL, by non-EMSL staff. Capturing this data has proven to be a significant challenge since much of the user community's productivity resulting from use of EMSL is beyond our control. We have developed some mechanisms to help us get the information we need. To date 120 non-EMSL staff user publications have been captured. This compares with 172 in FY2000 which represented more than 15% growth over FY1999. More attention is needed to better capture and encourage these publications.

In FY2002 EMSL will implement a more comprehensive project life-cycle process including project closeout that will better capture research results including publications. This project management improvement also responds to an FY2001 DOE/OIG report finding that all non-proprietary research results have not reached OSTI.

**EMSL User Satisfaction:** One of the key measures of EMSL's contribution and relevance to the scientific community is user satisfaction. User satisfaction results are collected via survey. This survey helps us to understand our effectiveness at meeting the needs of researchers, and it helps us understand EMSL's impact. Finally, this survey helps us iden-

tify areas where we can improve. Results collected to date indicate that we are performing at an outstanding level. This is evidenced by the strong and highly positive responses we have received to our survey. Responses across several key questions are presented below:

The response rate to the User Satisfaction so far is 17 %. Overall, the results are very positive:

- ♦ 91 % of users are satisfied or very satisfied with the way the EMSL environment facilitated scientific accomplishment.
- ♦ 88 % of users were satisfied or very satisfied with the availability of the existing facilities and equipment.
- ♦ 82 % of users were satisfied or very satisfied with performance (e.g., were facilities and equipment maintained to appropriate specifications for your intended use)?
- ♦ 94 % of users were satisfied or very satisfied with the support provided by the EMSL staff.

Overall, 64% of EMSL users were very satisfied and 24% were satisfied. These numbers exceeded our expectations. The response rate to date is nearly double that in FY2000. We will continue to accept surveys and evaluate the results accordingly.

### Atmospheric Radiation Monitoring Program

The ARM Program, as a DOE multi-laboratory program with the Program Office at PNNL, continues to evolve and enjoy a high level of

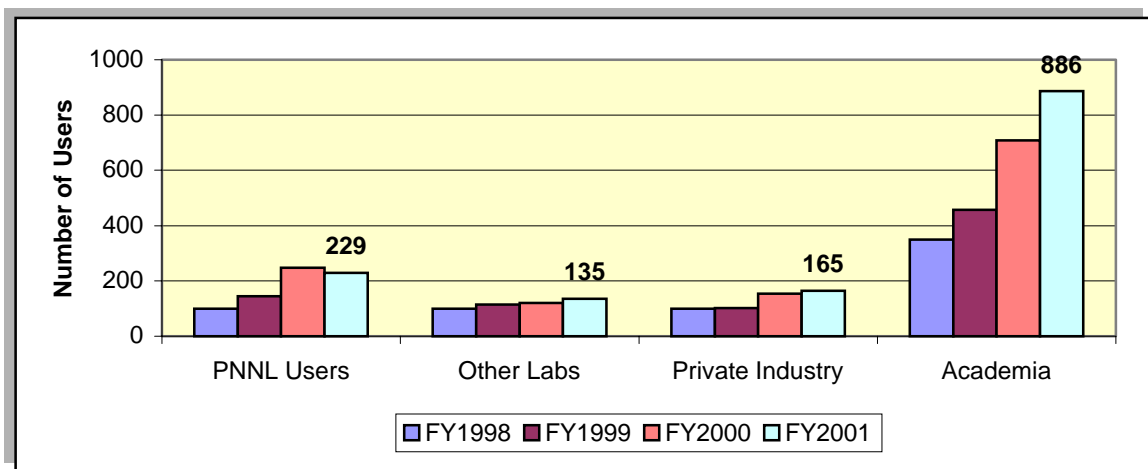


Figure 1.3. EMSL User Profile

success. Significant changes have been implemented in the structure of ARM and in PNNL's roles in it. During the last year, the data delivery functions of the ARM Experiment Center at PNNL were consolidated with the ARM Archive at Oak Ridge National Laboratory. At the same time the systems development functions ("ARM Engineering") was consolidated under management from PNNL and the day to day management of site operations was consolidated under management from Argonne National Laboratory. As a result of Tom Ackerman joining the staff at PNNL the previous year, the function of the Site Scientist for the Tropical Western Pacific Ocean site was moved to PNNL from The Pennsylvania State University. Publication growth by the ARM Science Team continued, providing insight into the productivity of the program as a whole.

**Data Delivery:** During the last year, data delivery activity of ARM has been consolidated at Oak Ridge National Laboratory and Site Operations management has been consolidated at Argonne National Laboratory in compliance with a reorganization of ARM as mandated by DOE. These

changes have resulted in reduced costs, accommodating DOE budget limitations, but not allowing for highly desired improvements in data acquisition and modeling activity. The ARM Data archived has reached nearly 14 terabytes and data volume is accelerating with new high data production instrument systems becoming operational. The Archive is responding to an average of 750 data requests per month, a 25% increase from a year ago. New requests are dominated by investigators not affiliated with ARM.

**Publications:** Peer reviewed publications continue to increase at about 10% per year, reaching 158 publications in FY2002, a number that is still being tallied as DOE gathers research progress reports. Figure 1.4 illustrates the continuing annual growth in ARM publications.

**Customer Satisfaction:** With the consolidation of data delivery functions at ORNL, the User Satisfaction survey germane to the PNNL Experiment Center was discontinued. A new survey, to be distributed from the Program Office at PNNL, will assess customer satisfaction with data from the

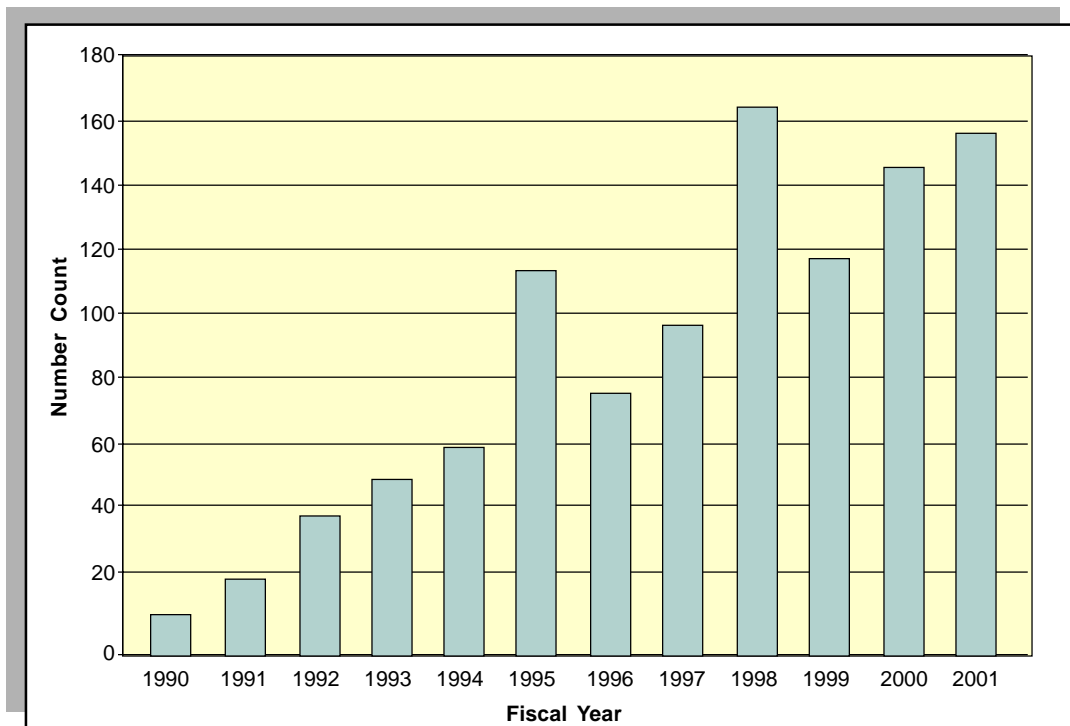


Figure 1.4. ARM Peer Reviewed Publications and Funded Research Efforts

Program as a whole and will be dependent upon investigators requesting data from the Archive. The general success of the Program is strongly indicated by the continuing rise in data requests received by the Archive.

### **G-1 Aircraft Operations**

Although not among the critical outcomes for FY2001, continued effective operation of the G-1 aircraft in support of DOE research programs is an important activity within the Fundamental Sciences mission area. In FY2001, the G-1 was engaged in two major field studies: the Phoenix 2001 Air Quality Study (PHX01), and the Pacific Northwest 2001 Air Quality Study (PNW01). The US Environmental Protection Agency and DOE jointly funded the PNW01 study. Between the two studies, 55 research flight hours were delivered over a period of 6 weeks in extremely hot conditions without loss of research time due to aircraft malfunction. Investigators from Argonne National Laboratory, Brookhaven National Laboratory, University of California - Davis, and Battelle Columbus Operations participated with PNNL scientists in these field studies. In PHX01, aircraft measurements were conducted in concert with observations from two floors of a tall building in downtown Phoenix and meteorological and air quality measurements at several local monitoring sites. Several special sampling devices were flown in PNW01 to measure in real-time volatile organic compounds and sample aerosol particles for post-flight individual particle and time-resolved bulk composition analyses. PNW01 was coordinated with special measurements in the Puget Sound basin by other PNNL groups, Washington State University, and with a similar Canadian study in the Fraser River airshed.

The research aircraft operations project completed the year within budget while adding two new copilots to the flight crew and training them for research flying. Feedback from the Research Aircraft Advisory Panel convened in May identified a stable charging algorithm as the most important action to promote the use of the G-1 by non-DOE users. An accounting practice change that eliminates the year-end variance adjustment to

G-1 use rates will make this possible in FY2002.

### **Terrestrial Carbon Sequestration Consortium (CSiTE)**

CSiTE is a distributed research consortium led by PNNL and Oak Ridge National Laboratory with Argonne National Laboratory, seven universities, two USDA research laboratories, and two independent research centers functioning as collaborating partners. CSiTE uses collaborative partnerships to conduct new basic research as well as to analyze existing knowledge and experience to develop the scientific understanding needed to evaluate the feasibility of environmentally sound strategies for enhancing carbon sequestration in terrestrial ecosystems. Performance was measured by three supporting indicators: 1) Number of publications, presentations and workshops, 2) CSiTE funding relative to that of OBER, and 3) Demonstration of the impact of CSiTE research to the nation. Based upon our results we rate our overall performance as excellent.

During FY2001, 15 peer reviewed articles, 6 book chapters, one conference paper, and 3 formal reports were written and 16 invited presentations were given by PNNL staff and their collaborators. A renewal proposal was submitted and was funded for an additional three years. In addition, \$90K in capital equipment support for CSiTE research was awarded to PNNL in FY2001. The impact of CSiTE research is seen by the level of industry interest and engagement, which has included unsolicited inquiries for collaboration opportunities from Tennessee Valley Authority, and America Electric Power Company. CSiTE is leading an upcoming (November, 2001) industry and government partnership workshop on terrestrial carbon sequestration research to be held in Lexington, Kentucky, at which nearly 70 participants from the public and private sectors are registered to participate.

Based on our expectations for this year, publications, presentations, workshops and funding provides demonstration of impact to the nation and is considered excellent.

## 1.4 Effectiveness and Efficiency of Research Program Management

### Results

The Laboratory receives feedback from several sources throughout the year on program management. Feedback includes interviews with key DOE program managers, Laboratory Review Committee feedback, proposal reviews, and DOE program peer reviews. Results from these reviews indicate that our program management is **Outstanding**. We are already actively working on resolution of any and all issues/actions discussed.

### Analysis

#### DOE-SC Interview

PNNL conducts personal interviews with key program managers. The Fundamental Science Division (FSD) Associate Laboratory Director (ALD) conducted an interview with DOE-RL and Ari Patrinos with DOE-OBER, focusing on:

- ♦ The quality of our leadership,
- ♦ Our ability to effectively team with other laboratories and universities,
- ♦ The degree of Laboratory Institutional support provided, and
- ♦ Overall program management.

The interview focused on our leadership in programs chosen from the following:

- ♦ Atmospheric Radiation Measurement (ARM)
- ♦ Molecular Sciences Computing Facility (MSCF)
- ♦ Environmental Molecular Sciences Laboratory (EMSL)
- ♦ Biomolecular Networks Initiative (BNI)
- ♦ Teaming and working with other labs and universities
- ♦ Institutional commitment to Life Sciences
- ♦ Natural and Accelerated Bioremediation (NABIR)

*Attendees:* Ari Patrinos (DOE-SC), Jeff Day (DOE-RL), Bill Rogers (PNNL), Ellyn Murphy (PNNL), and Bill Hertz (PNNL)

Ari Patrinos' comments are summarized below by topic area.

*ARM:* ARM continues to be the flagship of the OBER Global Climate Change Program. The leadership of Tom Ackerman is extremely important to ARM. ARM has made a significant contribution to reducing the uncertainty in atmospheric data. Kudos to Tom on his leadership and management of the on-going, diverse, and complex scientific programs of ARM. Ari has “absolutely no complaints” about the ARM program. We need to be vigilant to stay on the cutting edge as this program receives intense scrutiny, and the fate of the OBER Global Climate Change Research program is uncertain.

*MSCF:* DOE is concerned about funding for next year and out years in this period of tight budgets. There is also concern that our requested funding not become a mortgage but a permanent increase in the base budget. OBER is pleased with the work being done by MSCF. OBER seeks to maintain a diverse computing capability across the different programs it administers and not put “all our eggs in one basket”. However, during tight budget cycles there is a tendency for the different SC offices to “take control” of their primary mission areas. For that reason PNNL may not get all the funding it requests for MSCF. PNNL is not alone; the same message has been communicated to National Energy Research Scientific Computer Center (NERSC) and other computing groups that OBER tries to support.

*EMSL:* OBER has “no complaints” regarding EMSL. Ari Patrinos is particularly delighted with Jean Futrell's leadership of EMSL, his scientific credentials, and the academic contacts he has.

*BNI:* BNI represents the future and maps very well with DOE's Genomes to Life program. The leadership is “quite good”—Ari Patrinos gives a “high grade” for leadership. OBER recognizes and supports our continued attempts to attract and acquire additional senior leadership. Funding for the Systems Biology facility is a concern due to overall funding issues. The SC budget outlook is grim. We are advised not to make the facility a requirement for the success of our systems biology

research, or we risk losing research work without it. OBER is very interested in working with PNNL on developing joint funding partnerships with NIH. OBER recognizes that developing funding in this area is difficult, but OBER/PNNL needs to strive to do this.

*Teaming with Labs and Universities:* OBER has seen a “marked improvement” and is very pleased with our efforts to team with universities. Of particular note are our partnerships with University of Washington, OHSU and the rest of Oregon’s university system. Teaming across the Battelle managed labs is also good, but more needs to be done. There is a tendency in all national labs to try to hold too close research areas in which they have an edge for fear of losing that edge. While this is a human trait, we can’t tolerate it during this time of tight budgets. PNNL’s lead in proteomics is an example of an area where PNNL needs to reach out to other Labs and universities. Dick Smith is one of our brightest lights.

*Institutional Commitment to Life Science:* OBER is “very thrilled and appreciative” of our obvious commitment to Life Sciences.

*NABIR:* OBER is aware of PNNL’s increased recognition in this program and it couldn’t come at a better time. The program is well managed and will get additional recognition now that they are going to the field. OBER is proud of the program. OBER wants NABIR to be more recognized by EM-50 and other DOE offices.

### Other Review Feedback

In *LRC* remarks it was noted that PNNL contains “no dead wood” and that the focus is on high quality from research staff up to management.

*Proposal* reviews are another indication of effective and efficient management. The Laboratory has established an organized and rigorous vetting process by which only the most competitive proposals are submitted. This contributed to a very high success rate in FY2001 that benefited both the Laboratory and DOE.

The *Chemical Physics Program* review stated that PNNL “should take great pride in an excellent sci-

entific program that maintains both high scientific quality and relevance to the DOE mission.” In response to reviewer suggestions regarding program maturation and funding issues, the EMSL team developed and presented a path forward that was readily endorsed by BES management demonstrating the Laboratory’s ability to implement suggestions that will better utilize capabilities.

The *Materials Science Program* reviewers took special note of upper management’s commitment to the program. They were highly complimentary of all of the six research areas they reviewed, showing a uniformly positive impression of program management in these areas. In one area it was noted that PNNL is the only place where this innovative work could be pursued. They noted that “progress is remarkable” in spite of inadequate budgets which is a testament to the effectiveness and efficiency of research program management.

Of particular note was Pat Dehmer’s comment that she considers our *Chemical Science Program* one of the best managed in BES, comparable with the Combustion Research Facility at Sandia.

Finally, in follow-up to a study commissioned by OBER in FY2000, Mina Bissell, Director of life sciences research at LBNL, led a BER-commissioned panel of reviewers in a review of our progress report on our mass spectrometry proteomics program which was submitted in May FY2001. A review of the progress report was received on August 21<sup>st</sup>. The review recognized the substantial technological progress made in the program and the prospective high value of the instrumentation developed at PNNL for biological research. However, the review raised significant concerns regarding the appropriate mix between technology development and experimental biology and progress towards making the technology readily available to the biological community. In response to this review, we have accelerated our efforts to set up a steering committee to oversee the biological aspects of the project. Biweekly meetings between biologists and the technology development staff have been established to identify and expedite appropriate biological studies. We continue to work with BER to resolve any remaining issues.



## Environmental Quality Mission

Many of the indicators we use to determine our level of performance and predict how our customer will view our performance transcend one or more of the four key objectives identified in the Performance Evaluation and Fee Agreement. It is important to note that no one objective can stand alone. However, specific results by program are provided in section 1.4. It should also be noted that the Objective entitled, “Success in Constructing and Operating Research Facilities”, is not applicable to this mission area.

## Office of Environmental Management (DOE-EM)

The Pacific Northwest National Laboratory (PNNL) conducts work funded by the Department of Energy’s (DOE) Office of Environmental Management (EM). A structural view of the work is shown in Figure 1.5, with funding by structural element presented in Table 1.3.

The performance results that follow are reported against the work identified in Figure 1. The results respond directly to Critical Outcome Objectives 1.1, 1.2 and 1.4 and reflect the **Outstanding** quality, relevancy and programmatic performance we deliver.

### 1.1 Quality of Science and Technology

#### Results

Our FY2001 accomplishments indicate that we continue to enhance the underlying science and technology required to complete EM’s cleanup mission. Our contributions to the underlying science and technology become solutions to specific problems or knowledge that impacts baseline plans by reducing risk, schedule, and/or cost. Our contributions coupled with our leadership roles in EMSP, TFA, and our science and technology roles supporting the Office of River Protection and its contractors, are strong evidence that we continue to do an outstanding job of delivering important, impactful, and innovative science and technology to EM. Based on our FY2001 accomplishments, we rate our performance against the Quality Science and Technology objective as Outstanding.

## Analysis

The high quality science and technology work we conduct on behalf of EM continues to advance the knowledge base required to complete the cleanup of DOE sites. Highlights from our key programmatic areas are presented below.

### Hanford Solutions

**Central Plateau (PHMC):** We provide Technology Management Leadership to the Hanford Central Plateau through the PNNL – Fluor Hanford Technology Management Memorandum of Agreement. The work is in direct support of the Hanford Site cleanup mission and critical Hanford problems, including spent nuclear fuel retrieval, handling, packaging and drying, stabilizing, and managing plutonium at Hanford’s Plutonium Finishing Plant. High quality science and technology innovations include:

- ♦ Performed data analysis to increase understanding of fuel behavior in order to enhance project baselines
- ♦ Conducted studies to determine metal corrosion rates and particle sizes in K Basin sludge to determine safety margins for sludge retrieval and storage
- ♦ Worked jointly with a Fluor Hanford team to resolve gas purity questions for the helium used in the process of drying and storing spent nuclear fuel from the K Basins
- ♦ Provided technical support for the implementation of an additional Pu precipitation process using oxalic acid to remove Pu from solutions
- ♦ Developed a creative solution to capture and remove volatile chloride salts from Pu oxides during thermal stabilization
- ♦ Enhanced a magnesium hydroxide precipitation process to remove Pu from solutions
- ♦ Simplified a polycube stabilization process
- ♦ Developed a Pu Thermal Treatment Furnace System to expedite thermal stabilization of plutonium
- ♦ Developed a “breakthrough technology” to remotely monitor pressure and temperature in Pu canisters using Radiofrequency Tag technology

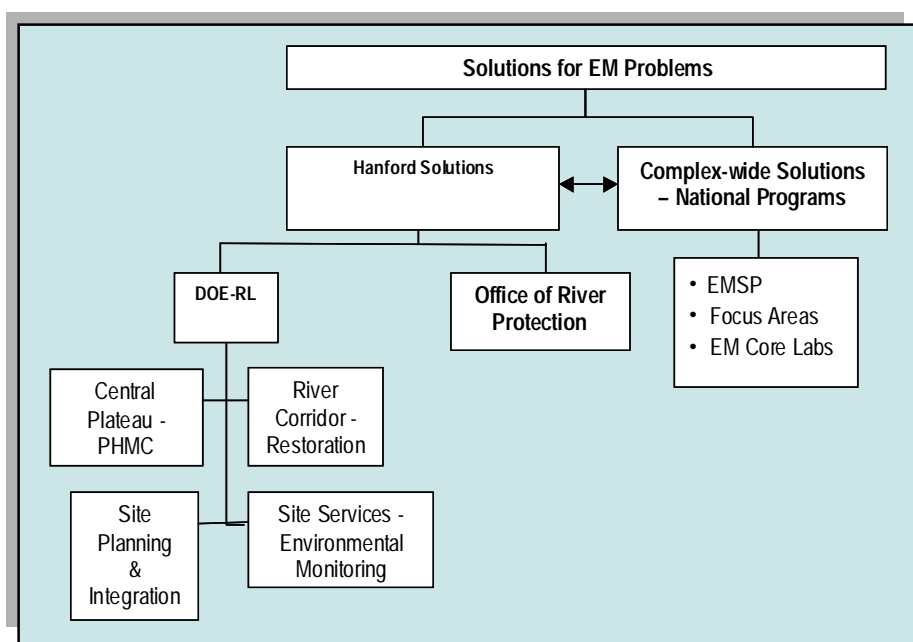


Figure 1.5. A Structural View of EM Work at PNNL

Table 1.3. FY2001 Funding

Structural Elements	FY2001 Funding (\$M)	FY2001 Funding (% of Total)
Hanford Solutions:		
DOE-RL	62	54%
Office of River Protection	30	26%
Complex Wide Solutions - National Programs	22	20%
Total	114	100%

**River Corridor (Restoration):** Our Groundwater Vadose Zone work with Bechtel Hanford is part of the Integration Project at Hanford and is helping establish the technical basis for cleanup decisions. The work was reviewed in FY2001 by two key panels. A National Academy of Sciences/National Research Council committee completed a review of the Hanford Science and Technology program, focused on groundwater and vadose zone issues. The committee concluded the work is technically meritorious and is likely, at least in some cases, to make important contributions to advancing scientific knowledge. Chris Whipple, chairman of the committee, began his briefing to Jessie Roberson, EM-1, by stating, "This is the most positive NRC/National Academy of Sciences report about Hanford that has been written."

The Integration Project Expert Panel (IPEP) also reviewed the Integration Project. IPEP's FY2001 review focused on the System Assessment Capability, Vadose Zone Characterization, and Science and Technology Projects. The IPEP concluded notable progress had been made on many technical fronts, and commended the Integration Project and underlying core projects for their accomplishments to date.

In addition to the feedback from the committee/panels noted above, other performance highlights include:

- ♦ Increased understanding of Tc99 through the formation of a new collaboration with ecological risk assessment experts in England. The collaboration will focus on information exchange regarding biological uptake of radionuclides, particularly Tc99. We also conducted experiments to determine fate and transport of Tc99 in aquatic species.
- ♦ Completed the first year geochemical analyses of core samples from S-SX Tank farms and transport modeling. The results are summarized in an S&T Appendix for the S-SX Field Investigation Report. The results, including contributions from EMSP projects, provided insight to migration potential of contaminants beneath the tank farms.
- ♦ Completed two years of field experimentation for the vadose zone involving collaborations with other national laboratories, private contractors, and EMSP investigators. The measurements, analysis, and draft results on the FY2000-2001 Vadose Zone Transport Field Study were summarized in a draft report that will be published in October, 2001. The results from these studies will help quantify infiltration and



migration of contaminants in the unsaturated zone, including addressing the importance of fine-scale heterogeneities in water and contaminant transport, and addressing the scaling of laboratory measurements to field scale.

- ♦ Completed groundwater/Columbia River interface studies for Hanford's 100-D and H areas in support of Record of Decision mandated activities along the Columbia River corridor.

**Office of River Protection (ORP):** We supported the ORP mission by providing key science and technology results that impact the design and operation of the Waste Treatment Plant. We serve in key science and technology leadership roles under the Waste Treatment Plant's Research and Technology Manager. We are the CHG Project's Science and Technology Lead. FY2001 performance highlights include:

- ♦ Developed a Receptor Risk Module for the River Protection Project Life Cycle Model to examine the impact of various retrieval, leak rate, and tank closure scenarios on the long term health risk to different receptors in Hanford's 200 Area and along the pathway to the Columbia River
- ♦ Developed and demonstrated with actual waste, an on-line monitor for Tc ion exchange
- ♦ Completed bench scale experiments to provide an understanding of the mechanism for the Sr/TRU removal process; completed Sr/TRU removal and cross-flow filtrating tests, small column Cs IX tests, and draft characterization reports with actual tank wastes from AP-101, AN-102, and C-104
- ♦ Completed a review draft of the integrated River Protection Project Science & Technology roadmap.
- ♦ Provided process planning, initial proof-of-concept demonstrations, and leak detection technology for the ongoing Single Shell Tank saltcake dissolution and retrieval program
- ♦ Organized and participated in a workshop to plan for the removal of the floating organic layer in Hanford Tank C-103
- ♦ Published "Expert Panel Recommendations for Hanford Double Shell Tank Life Extension"
- ♦ Demonstrated successful performance of the proposed Waste Treatment Plant flowsheet and resulting waste glass product samples with radioactive waste from four different Hanford tanks
- ♦ Completed the first phase of large scale fluidic mixing and feed sampling system tests to characterize system performance and identify limitations

## Complex-wide Solutions – National Programs

### Environmental Management Science Program (EMSP):

We continue to deliver quality science through the EMSP. A PNNL-led EMSP project earned a 2001 R&D 100 Award for the Milliwave Viscometer. We continue to maintain the largest portfolio of EMSP projects, all selected through a rigorous internal and external review process. We continue to communicate successes achieved at both PNNL and throughout the program. At the most recent American Chemical Society National Meeting, we led workshops on EMSP projects supporting Ground Water/Vadose Zone Integration and two symposia.

As well as providing value to the DOE-EM clean-up mission, our EMSP researchers are making contributions to the quality of science across multiple DOE offices. The area of bioremediation is a prime example. Our EMSP portfolio contains projects investigating the application of bioremediation technologies to reduce risks faced by EM in facility D&D and GW/VZ. These projects are drawing on our Environmental and Molecular Sciences Laboratory capabilities, and making advances in fundamental science that are being transferred to projects and proposals under OBER and NABIR, the primary programs for development of bioremediation technology within DOE.

**Tanks Focus Area (TFA):** We led the TFA technical team in developing technical responses to DOE site needs to safely and efficiently remediate radioactive waste stored in underground tanks, and in developing technical solutions (including multi-year programs) to address the needs. We prepared

the annual Site Needs Assessment and Multi-year Program Plan (MYPP) to formally document the planned program. The MYPP is reviewed and approved by the Site Assistant Managers of the high-level waste sites and DOE HQ Deputy Assistant Secretaries. Site Assistant Manager approval and positive comments from participants continue to serve as strong evidence of product and program quality.

**EM Core Labs:** We are providing key contributions to complex-wide efforts to identify an acceptable moisture measurement technique for plutonium-bearing materials. We conducted tests to validate alternative analytical methods. Priority is being given to the challenges at Rocky Flats and Hanford.

We are key members of a team developing consensus guidance for an ASTM drying standard. The drying standard will apply to drying DOE spent fuel for the interim dry storage facility and for commercial light water reactor fuel for the Independent Spent Fuel Storage Installation.

We are working with INEEL, SRTC, and ORNL to establish a subsurface science topical computational center in conjunction with the Environmental and Molecular Science Laboratory computer facility. In addition, we are supporting INEEL with developing a strategy for the emerging National Vadose Zone Initiative, to transform the National Vadose Zone Roadmap into a funded research and development program.

## 1.2 Relevance to Mission

### Results

We continue to deliver science and technology that is very relevant to DOE's Environmental Quality Research and Development Portfolio and EM's mission. Our work contributes to the national research agenda by spanning several elements of DOE's Environmental Quality (EQ) Research and Development (R&D) Portfolio. Our work supporting Hanford's River Corridor and Central Plateau and our TFA work are strong contributors to progress against the EQ R&D elements for Management of High-Level Waste and Environmental

Remediation. Our EMSP work crosscuts the EQ R&D portfolio and contributes to U.S. leadership in the international scientific and technical community. Our work is resulting in reductions in the risk, time and cost required to meet EM cleanup objectives at Hanford as well as other sites across the complex. Our FY2001 accomplishments are strong evidence of successfully delivering science and technology that advances cleanup at Hanford and other DOE sites. Based on our FY2001 accomplishments, we rate our performance against the Relevance to Mission objective as **Outstanding**.

### Analysis

Our work for EM continues to be highly relevant to DOE's Environmental Quality Research and Development Portfolio and EM's mission. Highlights from our key programmatic areas are presented below.

#### Hanford Solutions

**Central Plateau (PHMC):** We provide Technology Management Leadership to the Hanford Central Plateau through the PNNL-Fluor Hanford Technology Management Memorandum of Agreement. The work is in direct support of the Hanford Site cleanup mission, and is resulting in time and money savings as well as risk reduction for critical Hanford problems, including spent nuclear fuel retrieval, handling, packaging and drying, stabilizing and managing plutonium at Hanford's Plutonium Finishing Plant, and deactivation of highly contaminated facilities.

- ♦ Performance highlights from our work with Fluor Hanford on spent nuclear fuel retrieval, handling, packaging and drying include:
  - Performed an analysis of the technical basis for loading spent fuel scrap, including reactive fuel fragments, into Multi-Canister Overpacks
  - Evaluated 1500 preventative maintenance tasks using decision support software we developed for the Department of Defense. Evaluation resulted in savings greater than \$2M through modernization, reduction or elimination of preventative maintenance tasks

- Performed data analysis to increase understanding of fuel behavior in order to enhance project baselines
  - Conducted studies to determine metal corrosion rates and particle sizes in K Basin sludge to determine safety margins for sludge retrieval and storage
  - Teamed with Fluor Hanford staff to resolve gas purity questions for the helium used in the process of drying and storing spent nuclear fuel from the K Basins, maintaining a tight timetable to begin removing fuel from the Basins
  - ◆ Performance highlights from our work with Fluor Hanford to stabilize and manage plutonium (Pu) at the Plutonium Finishing Plant (PFP) include:
    - Provided technical support for the implementation of an additional Pu precipitation process using oxalic acid to remove Pu from solutions
    - Developed a solution to capture and remove volatile chloride salts from Pu oxides during thermal stabilization by adding an air quench system to the muffle furnace, reducing work hours needed to stabilize the material and worker exposure during the processing.
    - Enhanced a magnesium hydroxide precipitation process to remove Pu from solutions resulting in increased Pu stabilization
    - Simplified a polycube stabilization process to convert cubes to a safe form for storage – stabilization will occur in FY2002
    - Developed a Pu Thermal Treatment Furnace System to expedite thermal stabilization of plutonium and significantly reduce cycle times
    - Identified a “breakthrough technology” to remotely monitor pressure and temperature in Pu canisters using Radiofrequency Tag technology. Remote monitoring reduces worker exposure and enhances security. Savings are expected to exceed \$10M
  - ◆ Performance highlights from our work in support of deactivating highly contaminated facilities at Hanford include:
    - Provided specification development, system modeling, and factory acceptance expertise to a fully integrated Fluor Hanford/PNNL project team for planned deployment of a robotic arm to expedite 324 hot cell deactivation.
    - Completed technical evaluation of the feasibility of removing 327 building hot cells in a monolith
- River Corridor (Restoration):** Our Groundwater Vadose Zone work with Bechtel Hanford is helping establish the technical basis for cleanup decisions at Hanford and at other sites in the DOE complex. Performance highlights include:
- ◆ Completed the first year geochemical analyses of core samples from S-SX Tank farms and transport modeling. The results are summarized in an S&T Appendix for the S-SX Field Investigation Report. The results, including contributions from EMSP projects, provided insight to migration potential of contaminants beneath the tank farms. The results contributed to resolution of critical issues such as mobility of cesium-137 in the vadose zone that have been hampering cleanup efforts at the Hanford site, and will also aid upcoming decisions on tank retrieval and retrieval technology selection and/or use.
  - ◆ Completed two years of field experimentation for the vadose zone involving collaborations with other national laboratories, private contractors, and EMSP investigators. The measurements, analysis, and draft results on the FY2000-2001 Vadose Zone Transport Field Study were summarized in a draft report that will be published in October. The results from these studies will help quantify infiltration and migration of contaminants in the unsaturated zone, including addressing the importance of fine-scale heterogeneities in water and contaminant transport, and addressing the scaling of laboratory measurements to field scale.
  - ◆ Completed groundwater/Columbia River interface studies for Hanford’s 100-D and H areas in support of Record of Decision-mandated activities along the Columbia River corridor.

- ♦ Completed installation of vadose zone monitoring equipment in the B, BX-BY and the SX tank farms, and initiated monitoring that will aid upcoming decisions on tank retrieval.
- ♦ Provided technology alternatives for low cost Vadose Zone monitoring at Hanford's Liquid Effluent Retention Facility – a key component of negotiations with Ecology for updating the facility's permit.
- ♦ Completed final testing of the System Assessment Capability (SAC), comparison of SAC results (e.g., contaminant migration, plume concentrations, arrival times) were matched against Hanford historical monitoring and characterization data, and used the SAC to perform an assessment of Hanford site cleanup. DOE, regulators, and stakeholders reviewed the initial results to refine the assessment techniques. The Office of River Protection requested that we develop a joint proposal with Sandia National Laboratory to integrate more detailed tank modeling into the SAC.

**Hanford Site Planning and Integration:** Our work with DOE-RL and Hanford stakeholders is helping set a path for successful cleanup at Hanford. We led a regional effort to identify constraints and challenges to Hanford cleanup. The constraints review (C3T) participants included DOE, the Environmental Protection Agency, and the Washington State Department of Ecology. The four parties agreed to collectively address four major constraints to Hanford cleanup. We worked closely with the four parties to establish a collective agenda for Jessie Roberson's (EM-1) first visit to Hanford.

We continued to support DOE-RL staff on Hanford strategic planning and integration by aiding the development of key Hanford planning documents, including:

- ♦ Draft Richland Operations Office Strategic Plan (RLSP)
  - ♦ Draft Richland Operations Office Central Plateau Program Management Plan
  - ♦ Vision 2012 report to Congress
  - ♦ Science and Technology for Hanford Site Cleanup – A Strategic Assessment
  - ♦ RL EM Program Management Plan
- Hanford Site Services – Environmental Monitoring:** Our Environmental Monitoring work at the Hanford site provided key information for protecting site resources. The work is principally conducted through the Hanford Groundwater Monitoring Program and the Hanford Public Safety and Resource Protection Program. Performance highlights for each program include:
- ♦ Hanford Groundwater Monitoring Program
    - Completed an EPA required Groundwater Sampling and Analyses Plan for the 200-BP-5 Operable Unit. The requirement is part of the 5-year Record of Decision review process.
    - Employed geostatistical techniques to eliminate redundant groundwater monitoring locations for Hanford's 200-West Area carbon tetrachloride plume. 17 wells were eliminated from the sampling network.
    - Completed a Groundwater Quality Assessment Plan for Single-Shell Tank Waste Management Area U. The RCRA required assessment was due to the discovery of constituents/contaminants in the groundwater beneath U Tank Farm site.
    - Reached agreement with Ecology on an alternate statistical approach for monitoring 300 Area Process Trenches
    - Completed report on trichloroethene in groundwater near the Horn Rapids Landfill (City of Richland Landfill)
    - Supported the application of cone penetrometer technology at the 618-10/11 Burial Sites (elevated tritium discovery near Energy Northwest facilities). Samples were collected, results analyzed, and an evaluation provided to Bechtel Hanford for site characterization and remediation decisions.
    - Completed CY2000 Climatological Data Summary, Hanford Annual Groundwater Report, and the Hanford Site Environmental Surveillance Master Sampling Schedule
  - ♦ Hanford Public Safety and Resource Protection Program
    - The Hanford Site Biological Resources Management Plan was revised, presented to



the Hanford Site Management Board, and approved by DOE-RL. This document will be instrumental in Site decision-making relative to cleanup options, mitigation for restoration activities, and land-use alternatives.

- Completed CY2000 Hanford Site Environmental Report, which include summaries of the major environmental activities performed onsite during the year.
- Completed and distributed Hanford Site NEPA Environmental Characterization Report. The report provides a consistent description of the Site environment and is the primary environmental reference in preparation of Hanford NEPA, State Environmental Policy Act, and CERCLA documents.
- Completed the annual review and revision of the Institutional Review Board Continuing Human Subjects Review Application for the Hanford Cultural Resources Project. This assures continued compliance with requirements for human subjects research.

**Office of River Protection (ORP):** We supported the ORP mission by providing key science and technology and strategic technical planning, assessment and management support for the Waste Treatment Plant necessary to complete the cleanup of Hanford's highly radioactive tank waste. Performance highlights include:

- ♦ Modified and applied the River Protection Project Life Cycle Model in a baseline alternatives assessment to identify science and technology investment opportunities that could significantly lower costs and accelerate schedule.
- ♦ Developed a Receptor Risk Module for the River Protection Project Life Cycle Model to examine the impact of various retrieval, leak rate, and tank closure scenarios on the long term health risk to different receptors in Hanford's 200 Area and along the pathway to the Columbia River
- ♦ Led testing of six ex-tank leak detection technologies (external to tank) at the Hanford Mock Tank test site.
- ♦ Deployed topographical mapping system to Hanford Tank U-107 in support of planned FY2001 retrieval demonstration.
- ♦ Initiated deployment of Pit Viper Robotic System in Hanford Tank C-104
- ♦ Designed, fabricated and installed a cross-flow filtration unit for testing actual waste samples in the Radiochemical Processing Laboratory's hot cells.
- ♦ Completed bench scale experiments to provide an understanding of the mechanism for the Sr/TRU removal process; Sr/TRU removal and cross-flow filtration tests; small column Cs IX tests; and draft characterization reports with actual tank wastes from AP-101, AN-102, and C-104
- ♦ Developed and demonstrated an on-line monitor with actual waste for Tc ion exchange
- ♦ Completed and submitted Regulatory Data Quality Objective Reports for 9 of 12 analyses for the sand and water matrices, and 7 of 12 analyses for the actual waste matrix.
- ♦ Completed reports on vitrification and product testing of actual waste samples.
- ♦ Upgraded Tempest computational fluid dynamics model to simulate pulsed jet mixers.
- ♦ Completed a review draft of the integrated River Protection Project Science & Technology roadmap.
- ♦ Provided process planning, initial proof-of-concept demonstrations, and leak detection technology for the ongoing Single Shell Tank Saltcake Dissolution and Retrieval program
- ♦ Organized and participated in a workshop to plan for the removal of the floating organic layer in Hanford Tank C-103
- ♦ Co-authored Tank Space Options study with CHG for Tri-Party Agreement milestone M45.
- ♦ Published "Expert Panel Recommendations for Hanford Double Shell Tank Life Extension."
- ♦ Demonstrated successful performance of the proposed Waste Treatment Plant flowsheet and resulting waste glass product samples with radioactive waste from 4 different Hanford tanks.

- ◆ Completed the first phase of large scale fluidic mixing and feed sampling system tests to characterize system performance and identify limitations.

### Complex-wide Solutions – National Programs

**TFA:** Our TFA work continues to result in technology deployments that benefit remediation of radioactive wastes stored in underground tanks at DOE sites. Equally important are TFA activities that deliver technical solutions in the form of data and recommendations to site users to support project decisions, future direction, and validate baseline assumptions. Performance highlights include:

- ◆ Completed the Savannah River Site Salt Processing Project (SPP) R&D Summary Report and evaluation of the three SPP alternatives to support downselection.
- ◆ Deployed an enhanced electrochemical noise/multi-instrument tree corrosion probe in Hanford double-shell tank AN-104.
- ◆ Deployed electrochemical noise corrosion probe in Oak Ridge Reservation Tank W23 to support tank integrity monitoring of a Melton Valley Storage Tank
- ◆ Completed operational acceptance and cold testing of the Pit Viper robotics technology for Hanford and prepared the system for early FY2002 deployment
- ◆ Deployed video inspection system for tank characterization and sludge mapping in Oak Ridge Reservation's Melton Valley Storage Tanks
- ◆ Deployed Tank Heel Retrieval System in INEEL Tank W-182 to ensure effectiveness for final tank cleaning
- ◆ Completed deployment of the Russian Pulsating Mixer Pump at Oak Ridge Reservation to support waste retrieval from tank TH-4.
- ◆ Completed initial demonstrations of a full-scale fluidic saltcake retrieval system for Hanford tank S-102
- ◆ Completed first melter test runs to provide critical flowsheet data supporting INEEL sodium bearing waste treatment process design.
- ◆ Completed independent HLW Melter Study and Review with recommendations on future R&D to reduce costs of HLW vitrification at Hanford

**EMSP:** We continue to demonstrate outstanding leadership in EMSP. Our effectiveness at managing EMSP investments to deliver science and technology solutions to site cleanup problems is shown in Figure 1.6. By pre-screening proposals for relevancy to critical EM problems, coaching PIs during the early stages of awards, and actively transitioning the projects to the next stage in maturity, all projects have successfully achieved major goals with a high level of networking to end-users and delivering technology/data to facilitate clean-up activities across the DOE complex. Many EM problems require strategic long-term investments. This year's high number of renewals demonstrates our projects are successfully addressing these strategic problems.

## 1.4 Effectiveness and Efficiency of Research Program Management

### Results

We continue to do an outstanding job of delivering science and technology that contributes to EM's goals and objectives in an efficient and effective manner. We deliver products on time while meeting customer expectations. We team effectively with our customers to develop plans and alternatives for using science and technology to solve critical EM problems. We effectively deploy technologies to reduce the risk, time, or cost associated with cleanup processes at Hanford and at other DOE sites. We leverage technologies developed by other DOE contractors to help solve Hanford cleanup problems. Our FY2001 accomplishments are strong evidence of successfully delivering quality science and technology that meets our customer's expectations. Based on our FY2001 accomplishments, we rate our performance against the Efficient and Effective Research Program Management objective as **Outstanding**.

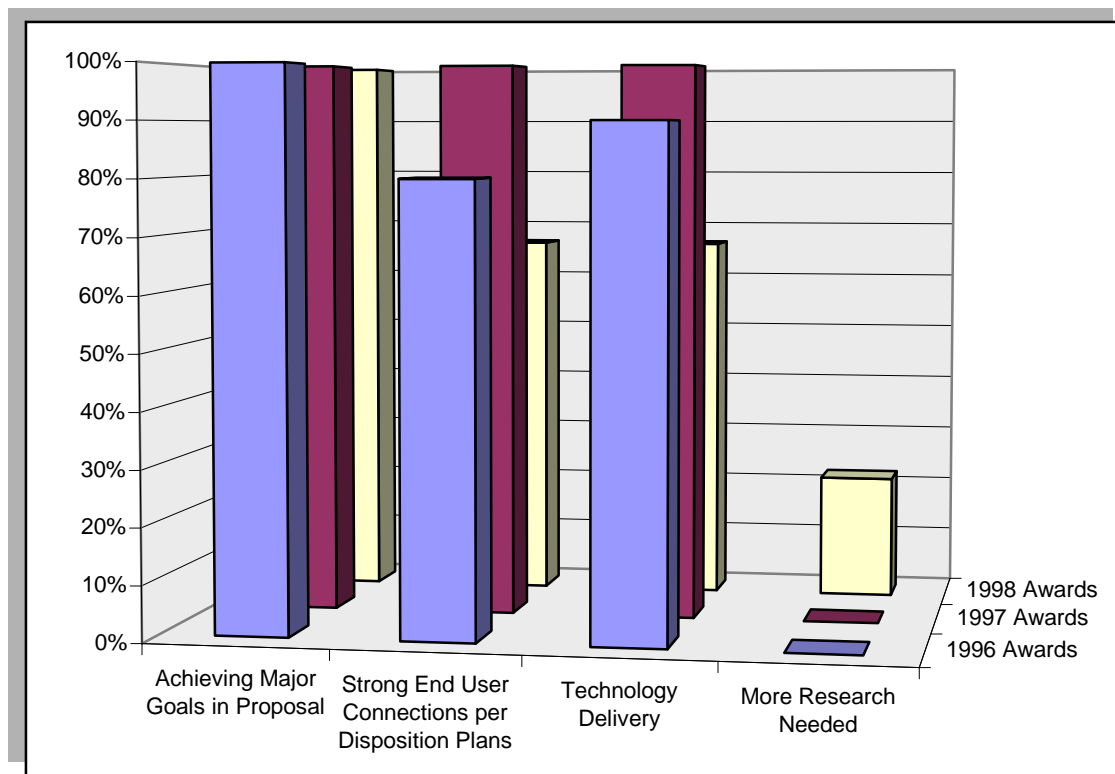


Figure 1.6. EMPS Results

## Analysis

We continue to deliver science and technology solutions that meet our EM customer expectations. Highlights from the programmatic areas are included in the following paragraphs.

### Hanford Solutions

**Central Plateau (PHMC):** Our work with Fluor Hanford on the Central Plateau is resulting in time and money savings as well as risk reduction for critical Hanford problems, including spent nuclear fuel retrieval, handling, packaging and drying, stabilizing and managing plutonium at Hanford's Plutonium Finishing Plant, and deactivation of highly contaminated facilities.

- Performance highlights from our work with Fluor Hanford on spent nuclear fuel retrieval, handling, packaging and drying include:
- Performed an analysis of the technical basis for loading spent fuel scrap, including reactive fuel fragments, into Multi-Canister Overpacks

- Evaluated 1500 preventative maintenance tasks using decision support software we developed for the Department of Defense. Evaluation resulted in savings greater than \$2M through modernization, reduction or elimination of preventative maintenance tasks
- Performed data analysis to increase understanding of fuel behavior in order to enhance project baselines
- Conducted studies to determine metal corrosion rates and particle sizes in K Basin sludge to determine safety margins for sludge retrieval and storage
- Teamed with Fluor Hanford staff to resolve gas purity questions for the helium used in the process of drying and storing spent nuclear fuel from the K Basins, maintaining a tight timetable to begin removing fuel from the Basins



- ◆ Performance highlights from our work with Fluor Hanford to stabilize and manage plutonium (Pu) at the Plutonium Finishing Plant (PFP) include:
  - Identified a creative solution to capture and remove volatile chloride salts from Pu oxides during thermal stabilization by adding an air quench system to the muffle furnace, reducing work hours needed to stabilize the material and worker exposure during the processing.
  - Enhanced a magnesium hydroxide precipitation process to remove Pu from solutions resulting in increased Pu stabilization
  - Simplified a polycube stabilization process to convert cubes to a safe form for storage; stabilization will occur in FY2002
  - Developed a Pu Thermal Treatment Furnace System to expedite thermal stabilization of plutonium and significantly reduce cycle times
  - Identified a “breakthrough technology” to remotely monitor pressure and temperature in Pu canisters using Radiofrequency Tag technology. Remote monitoring reduces worker exposure and enhances security. Savings are expected to exceed \$10M
- ◆ Performance highlights from our work in support of deactivating highly contaminated facilities at Hanford include:
  - Provided specification development, system modeling, and factory acceptance expertise to a fully integrated Fluor Hanford/PNNL project team for planned deployment of a robotic arm to expedite 324 hot cell deactivation.
  - Completed technical evaluation of the feasibility of removing 327 building hot cells in a monolith
  - Demonstration and deployment of robotic technologies to expedite deactivation of highly contaminated facilities
- ◆ The Hanford Science and Technology Project was reviewed by the National Academy of Sciences with very favorable results. Client feedback indicated this project is considered to be a “prototype” for EM-funded applied science programs.
- ◆ Provided technology alternatives for low cost Vadose Zone monitoring at Hanford’s Liquid Effluent Retention Facility – a key component of negotiations with Ecology for updating the facility’s permit.
- ◆ Completed final testing of the System Assessment Capability (SAC), comparison of SAC results (e.g., contaminant migration, plume concentrations, arrival times) were matched against Hanford historical monitoring and characterization data, and used the SAC to perform an assessment of Hanford site cleanup. DOE, regulators, and stakeholders reviewed the initial results to refine the assessment techniques. The Office of River Protection requested that we develop a joint proposal with Sandia National Laboratory to integrate more detailed tank modeling into the SAC.

**Hanford Site Planning and Integration:** We continued to support DOE-RL staff on Hanford strategic planning and integration. We led a regional effort to identify constraints and challenges to Hanford cleanup. The constraints review (C3T) participants included DOE, the Environmental Protection Agency, and the Washington State Department of Ecology. The four parties agreed to collectively address four major constraints to Hanford cleanup. We received very positive feedback from C3T participants.

We received positive feedback on key DOE-RL deliverables supporting Hanford strategic planning and integration. Key deliverables include:

- ◆ EM assessment package for Jessie Roberson (EM-1) visit
- ◆ Draft Richland Operations Office Strategic Plan (RLSP)
- ◆ Draft Richland Operations Office Central Plateau Program Management Plan
- ◆ Vision 2012 report to Congress

**River Corridor (Restoration):** We are helping establish the technical basis for cleanup decisions through our Groundwater Vadose Zone work with Bechtel Hanford. Performance highlights include:

- ♦ Science and Technology for Hanford Site Cleanup – A Strategic Assessment
- ♦ RL EM Program Management Plan

#### **Hanford Site Services – Environmental**

**Monitoring:** Our Environmental Monitoring work continues to protect site resources, generate opportunities for saving, and deliver products on time and consistent with customer expectations. Performance highlights include:

- ♦ Agreement with Ecology on an alternate statistical approach for monitoring 300 Area Process Trenches, reducing the number of well trips and samples required and resulting in savings greater than \$50K annually
  - Completed CY2000 Climatological Data Summary, Hanford Annual Groundwater Report, and the Hanford Site Environmental Surveillance Master Sampling Schedule on time and favorably received.

**Office of River Protection (ORP):** We continued our support to the ORP mission by providing key science and technology and strategic technical planning, assessment and management expertise. Our work continues to result in solutions to problems while reducing risk, time, and cost associated with the design and operation of the Waste Treatment Plant. Performance highlights include:

- ♦ Modified and applied the River Protection Project Life Cycle Model in a baseline alternatives assessment to identify science and technology investment opportunities that could significantly lower costs and accelerate schedule.
- ♦ Developed fact sheets and return-on-investment estimates for the initial set of high –priority science and technology projects that were identified to streamline the River Protection Project.
- ♦ Initiated deployment of Pit Viper Robotic System in Hanford Tank C-104
- ♦ Designed, fabricated and installed a cross-flow filtration unit for testing actual waste samples in the Radiochemical Processing Laboratory's hot cells.
- ♦ Received a letter of appreciation from Harry Boston for important contributions to closure of the flammable gas safety issue.

- ♦ Played a lead role in the development of strategies for waste form qualification and for simulant development and applications.
- ♦ Teamed with CHG and DOE to aggressively review and define acceptable solution pathways for meeting SST retrieval and closure milestones, including alternative treatment approaches to reduce waste volumes, treatment costs and schedules, and new methods for creating DST space and extending their useful life.
- ♦ Provided process planning, initial proof-of-concept demonstrations, and leak detection technology for the ongoing Single Shell Tank saltcake dissolution and retrieval program
- ♦ Co-authored Tank Space Options study with CHG for Tri-Party Agreement milestone M45.
- ♦ Named CHG Projects Science and Technology Lead
- ♦ Named by the Waste Treatment Plant Team's Research and Technology Manager to key science and technology leadership roles.
- ♦ Received letters of commendation from Carolyn Huntoon, Assistant Secretary for EM, for significant contributions in restructuring the Phase I Waste Treatment Plant Design and Construction Contract.

#### **Complex-wide Solutions – National Programs**

**EMSP:** Our management of EMSP work continues to demonstrate leadership and result in technology solutions to critical cleanup problems. Our effectiveness at managing EMSP investments to deliver science and technology solutions to site cleanup problems is shown in Figure 1.6. By pre-screening proposals for relevancy to critical EM problems, coaching Principal Investigators during the early stages of awards, and actively transitioning the projects to the next stage in maturity, all projects have successfully achieved major goals with a high level of networking to end-users and delivering technology/data to facilitate clean-up activities across the DOE complex. Our leadership in EMSP was further demonstrated through 16 FY2001 project awards. We received six project renewals demonstrating our progress towards addressing strategic long-term clean-up objectives and 10 new start awards. The new start awards are broad based collaborations targeting high risk

high return scientific problems facing the Tanks Focus Area.

**TFA:** Our TFA work continues to result in successful technology deployments while receiving high marks for effectiveness. Performance status and highlights include:

- ◆ Completed the Savannah River Site Salt Processing Project (SPP) R&D Summary Report and evaluation of the three SPP alternatives to support downselection. PNNL received a letter of commendation from Carolyn Huntoon, Assistant Secretary for EM, for contributions to SPP technology development and downselection
- ◆ Deployed an enhanced electrochemical noise/multi-instrument tree corrosion probe in Hanford double-shell tank AN-104
- ◆ Deployed electrochemical noise corrosion probe in Oak Ridge Reservation Tank W23 to support tank integrity monitoring of a Melton Valley Storage Tank
- ◆ Completed operational acceptance and cold testing of the Pit Viper robotics technology for Hanford and prepared the system for early FY2002 deployment
- ◆ Deployed video inspection system for tank characterization and sludge mapping in Oak Ridge Reservation's Melton Valley Storage Tanks
- ◆ Deployed Tank Heel Retrieval System in INEEL Tank W-182 to ensure effectiveness for final tank cleaning
- ◆ Completed deployment of the Russian Pulsating Mixer Pump at Oak Ridge Reservation to support waste retrieval from tank TH-4.
- ◆ Completed initial demonstrations of a full-scale fluidic saltcake retrieval system for Hanford tank S-102
- ◆ Completed first melter test runs to provide critical flowsheet data supporting INEEL sodium bearing waste treatment process design.
- ◆ Issuing a Mid-year Review Report documenting feedback from Users, HQ and other participants (very positive)
- ◆ Completed independent High-Level Waste Melter Study and Review with recommendations on future research and development to reduce

the costs of high-level waste vitrification at Hanford

- ◆ Successfully completed support of the Office of Inspector General audit of TFA which was discontinued early based on positive user feedback
- ◆ Prepared and issued through DOE two TFA calls for proposals for FY2002 work valued at nearly \$3M
- ◆ Continued excellent key deliverable performance consistent with past performance and expectations
- ◆ Continued significant and increasing role in guiding and managing EMSP HLW research
  - Established detailed science needs information consistent with National Research Council recommendations to enable effective FY2001 call for proposals
  - Engaged key EMSP projects at TFA's FY2001 Midyear Review
  - Connected EMSP PIs with TFA staff and problem holders to continue to improve EMSP project success
  - Prepared for HLW EMSP Kickoff meeting for 32 new EMSP projects

**EM Core Labs:** We are helping solve cleanup problems at other DOE sites by delivering technology developed at Hanford. We developed and delivered specialized remote systems, including a mechanical gripper, confined sluicing device, hydraulic cutter, and control station, to retrieve waste from Silos 1 and 2 at Fernald. Through testing, modeling, and analysis, we identified a successful operating configuration of Flygt mixers at Savannah River to remove sludge from a waste tank when one of three mixers failed. We conducted parametric vitrification studies of INEEL sodium bearing waste to determine optimal processing conditions and mercury behavior during immobilization in support of INEEL's baseline flowsheet design.

We are also leveraging technology developed at other sites or for other purposes to solve cleanup problems at Hanford. We are working with Oak Ridge National Laboratory's compact remote console with a robotic Pit Viper system that will be

used in tank valve pits at the Hanford Site to remotely retrieve contaminated equipment and clean out contaminated pits. We are supporting tank leak detection and vadose zone monitoring with electrical resistance tomography technology developed at Lawrence Livermore National Laboratory and in-tank partitioning tracer technology (PITT) originally developed for oil reserve work by Duke Engineering and the University of Texas.

## National Security Mission

The National Security mission area supports three key DOE-HQ Program Offices; the Office of Nonproliferation and National Security (DOE-NN), the Office of Intelligence (DOE-IN), and the Office of Counterintelligence (DOE-CN). Each office has its own unique issues and desired outcomes. The National Security mission area at PNNL is responsive to this fact. The results we continue to deliver, the relationships we continue to foster, and direct feedback from our customers clearly indicate that we are conducting **Outstanding** high quality, leading edge science research and technology programs. The following sections summarize our performance while reflecting the unique signatures of the Offices we support.

## Office of Nonproliferation and National Security (DOE-NN)

PNNL performance for NN activities conducted during FY2001 was rated as **“outstanding”** by the Deputy Administrator, NNSA

Through the work of the Pacific Northwest Center for Global Security (PNWCGS), PNNL was exceedingly successful in increasing the visibility and equity of the NN programs with the northwest academic, NGO, and congressional communities. We established what may be the first nonproliferation studies program at a publicly funded academic institution: the Institute for Global and Regional Security Studies at the University of Washington. We established a cooperative arrangement with the Seattle-based National Bureau of Asian Research (NBR) to work on projects of mutual interest. Some of this work will represent a significant public-private partnership between NN

and PNNL, and NBR, Microsoft, Boeing, General Electric, and other corporate interests. We continued our monthly global security seminar series, which has provided an excellent opportunity to expose NN programs to senior policy principals. This year these included Ambassador Robert Gallucci, GEN (Ret) John Shalikashvili, ADM Richard Mies (CINCSTRAT), and Dr. Victor Alessi. We were successful this year, with NN's guidance and encouragement, in elevating the concept of Russian debt conversion to a high level of interest in Congress, resulting in legislation introduced by several members, including Senators Biden and Lugar, and at least two separate letters from Congressmen to President Bush recommending the concept for consideration in advance of the June summit and the Genoa G8 meeting. PNNL has continued, under the auspices of the PNWCGS to promote for NNSA consideration the strategy of engagement of nuclear weapon states and other countries of concern based on nontraditional national security elements of environment, health, energy, and fundamental sciences.

## Nonproliferation Research and Engineering

The scientific and programmatic achievements for NN 20 reflect outstanding performance through successful research, development of prototypes, test and evaluation of developed sensors, and technology transfer. PNNL scientists developed a large, high resolution, 0.1 wave number spectral library for infrared sensors that is both quantified and qualified through joint efforts with the National Institutes of Science and Technology. This library now serves as the United States database for future sensor development and application, for both DOE and the users of its research. The fate and transport of these nonproliferation signatures in the environs were predicted through a successful merging of laboratory and field modeling efforts. New sensors for many of these signatures, using quantum cascade lasers, were assembled and evaluated as both point and distributed systems; these were cooperative efforts with Lucent Technologies and are being pursued with the DOE Kansas City Plant. Systems developed for the collection and analysis of radioactive Xenon and aerosol particles completed their field tests. The Xenon system, ARSA,



collected and analyzed for the first time, in near real time, the first Xe-135, -133, and -133m simultaneously at Freiburg, Germany; this system exceeded all requirements for nuclear explosion monitoring that were identified within the context of the CTBT by 40 fold. It operated autonomously for 18 months. The aerosol collection system, RASA, also continued its test and assessment; it successfully measured air particulate radionuclides with sensitivity below that required in the context of CTBT. Both systems' technologies were successfully transferred to industry for commercial production. RASA systems have been installed at most of the 11 US CTBT radionuclide-monitoring sites. Outstanding collaborations were developed with industry and university partners in materials research aimed at the development of high resolution, room temperature radiation detectors such as CdZnTe. New coatings were identified for use in the detection of organic species; the coatings that are specific to certain signatures of proliferation were made known to sensor developers and appliers. Scientists from PNNL chaired and participated in the development of roadmaps that provide the future direction for NN-20 R&D. Several outstanding PNNL accomplishments of NN-20 origin were acclaimed nationally through the R&D 100, the Federal Laboratory Consortium, and the Discovery Awards. These awards were based directly, or via concept development, on R&D from NN-20. They are: 1) Richard Craig, the 2001 Discover Magazine Innovation Award for the development of the Timed Neutron Detector for landmine detection, 2) Gordon Anderson and Kerry Steele (PNNL), and Curt Carrender, Jeff Cole, Ron Gilbert, Norman Hansen and Jeff Scott (Wave ID), R&D 100 Award for the Long-Range Semi-Passive Radio Frequency Identification System, and 3) Ted Bowyer, Harry Miley and Ray Warner, the FLC Award for the transfer of Radionuclide Detection Technologies for proliferation detection (ARSA and RASA).

### International Nuclear Safety and Cooperation

PNNL, serving as project manager for the National Nuclear Security Administration's International Nuclear Safety Program, supported the

NN-30 client in an exemplary manner during FY2001. The NN-30 director has repeatedly communicated to PNNL management and outside organizations that he is exceptionally pleased with PNNL performance.

The capability to implement projects in the former Soviet Union is evident in the success of our simulator, safety parameter display system, and Chernobyl Heat Plant projects, all of which provide significant, real safety improvement at operating nuclear plants. Eight full-scope simulators have been installed in Ukraine and Russia since 1997 at an average cost of \$12 million per system. In 2001, systems were installed at Rivne and South Ukraine Unit 1 nuclear power plants. A total of 13 safety parameter display systems have been installed in Ukrainian, Russian, and Armenian nuclear power plants since 1998 at an average cost of \$3 million per system. In FY2001, safety parameter display systems were completed at Zaporizhzhya Units 1, 4, and 6.

This June PNNL and its Ukrainian partners celebrated the on-time and under-budget completion of the Chernobyl Heat Plant with a dedication ceremony. The keynote speakers at the ceremony, U.S. Ambassador Carlos Pascual and Dr. James Turner, praised PNNL for the resounding success of the project. This venture was started at approximately the same time that other international organizations began related projects at Chernobyl, and INSP is the only organization to have completed a project.

During the Chernobyl Heat Plant effort, the project manager accepted a two-year assignment in Ukraine to manage the day-to-day contracting and construction details. A project support team was located in Richland, Washington. The project faced tremendous challenges including obstruction of design approvals by various Ukrainian agencies, delays in purchase and delivery of various components, and less than aggressive support for the schedule by the Chernobyl plant organization. Immersed in these challenges, our dedicated PNNL project manager and support team remained focused on critical actions and outcomes, minimized schedule slippages, and contained costs.

It is important to note that PNNL manages all of the nuclear safety projects with significant reliance on in-country resources (to stimulate the local economy), which creates many challenges. Resolving complex tax, customs, contracts, and regulatory issues, which are compounded by language and business barriers, is routine in the successful completion of these projects.

### **Arms Control and Nonproliferation**

PNNL continued to provide outstanding support to all of the NN-40 organizations in 2001. For the Initiatives for Proliferation Program, PNNL signed two CRADA's with a Pacific Northwest agricultural business, Dye Seed, to develop two products from a former Russian biological warfare institute. These are a unique microbe for oil and environmental cleanup, and an agricultural growth enhancer (SYMBIOT). For the Office of Nonproliferation Policy, PNNL conducted the first-of-a-kind fuel cladding corrosion study for the MAGNOX fuel that was canned in conjunction with the North Korean agreed framework. PNNL staff provided leadership to one of the world's largest and most important nonproliferation programs, the canning of spent fuel from the BN-350 Fast Breeder Reactor in Kazakhstan. A PNNL staff member led the technical delegation to the UK to participate in a warhead dismantlement campaign. Other PNNL staff members are serving as leaders in information barrier technology for related purposes. For the Office of Nuclear Transfer and Supplier Policy, a PNNL staff member managed the technology security policy implementation guidance for the DOE complex including how technology security is applied in instances of re-industrialization and equipment reuse. In support of the Office of International Safeguards, PNNL incorporated major refinements to the Graphite Isotope Ratio Method (GIRM), which is used to validate materials production declarations for graphite moderated reactors, to permit increased accuracy in GIRM estimates for certain site specific applications. For the Nuclear Cities Initiative, PNNL provided leadership in the development and management of International Development Centers in two of the Russian closed cities.

### **International Materials Protection and Emergency Cooperation**

PNNL support to NN-50 has continued to be outstanding again this year. PNNL has supported individual Headquarters program managers in efficiently and effectively managing a complex multi-laboratory program with a budget of over \$150M per year. PNNL staff members assist NN50 in managing about half of all the MPC&A infrastructure projects in Russia, including all the training and education projects, and two regulatory development projects. These projects build upon the considerable specialized expertise in these areas at PNNL. For example, at the Central Storage Facility for the Institute of Physics and Power Engineering, a major milestone was completed, as all special nuclear material has been counted and placed in a computerized database. This includes 20,450 accountable items in 339 containers, representing over 1,000 kg of U and 16 kg of Pu. Development and delivery of training and education courses has been similarly robust, having the effect of helping Russia to move farther along the road to the development of a real safeguards culture. A clear measure of the trust NN50 places in PNNL is the increasing leadership roles assigned to our staff members. A PNNL staff member was assigned by NN-50 to lead the project team for the International Training Center in Obninsk, Russia. Similarly, PNNL was assigned the leadership of the Mayak project, one of the largest facilities in the Russian nuclear weapons complex. Accomplishments include the installation of a series of interlocking concrete blocks at the Mayak facility, improving the security of over thirty tons of separated plutonium. The Mayak project has expanded to include the reprocessing facility and the highly enriched uranium arising out of reprocessing. Also, in a related area, in June PNNL hosted a visit by a Cabinet level Japanese delegation of emergency preparedness officials for NN-50. The visit was very well received and laid the foundation for further cooperation in this important area between NN and the Japanese.



## Materials Disposition

In 2001 PNNL has made significant scientific contributions to the Department of Energy's Office of Fissile Materials Disposition (NN-60) by utilizing both of Battelle's 1830 and 1831 contracts with DOE-RL. Under the 1830 contract, the Laboratory has been relied upon to conduct waste acceptance tests of immobilized Pu waste forms, to provide key support for the development of regulations in Russia, and to be a valued member of the Monitoring and Inspection Working Group led by NN-60. These contributions are essential to ensuring waste acceptance of immobilized Pu in the national repository and to successfully implement the Bilateral Pu Disposition Agreement between the United States and Russia. Under the 1831 contract, the Laboratory has been utilized to provide key support to the design activities associated with the Pit Disassembly and Conversion Facility, which will be commissioned to prepare 25 metric tons of weapons grade Pu in the United States for fuel fabrication.

Despite a suspension in the Pu Immobilization Program and a cancellation of the Pu Immobilization Facility Design Procurement at NN-60, PNNL has continued to provide data on the long-term radiation effects and leach behavior of immobilized Pu ceramic waste forms to support repository waste form acceptance. This data is thought by NN-60 to be critical to support the Immobilization Program once it is resumed in future fiscal years. In 2001, PNNL measured radiation damage effects on Pu-238 and Pu-239 doped materials prepared in FY2000. Operations were suspended temporarily in FY2001 due to contamination incidents associated with handling this and other material. PNNL underwent a rigorous process to examine and improve its operating procedures, and tests have subsequently been resumed under these improved procedures.

In support of the prime contractor (Washington Group International – WGI) responsible for designing the Pit Disassembly and Conversion Facility, PNNL staff were responsible for establishing the unclassified design basis for the facility

design. This accomplishment allowed the conceptual design to go forward in support of NN-60's program schedule by utilizing normal design space that exists at WGI's Denver, Colorado facility. In the meantime, the classified components of design are housed within the security infrastructure of PNNL. The PNNL project lead was replaced early in the fiscal year by another PNNL staff member and performance in meeting project milestones requiring coordination with other laboratories has significantly improved. Also in support of the Pit Disassembly and Conversion Facility design, PNNL staff, together with WGI, significantly reduced the size of the facility footprint to meet a \$735 million targeted estimate to complete. This resulted in an overall programmatic reduction of more than \$250 million for facility construction. PNNL staff helped identify the facility and process improvements needed to effect the reduction in facility footprint size, which ultimately drives construction costs.

PNNL utilized its regulatory and policy expertise to develop regulatory guidelines for the GAN regulatory agency in Russia. This support is critical to the implementation of the bilateral Pu disposition agreement recently signed by the United States and the Russian Federation in the summer of 2000. PNNL's regulatory support to GAN is essential to effective licensing and operation of Pu disposition facilities in Russia, needed to eliminate 34 MT of weapons grade Pu from the Russian stockpile. In FY2001 PNNL successfully achieved a breakthrough in contract negotiations with the GAN Scientific and Technical Center, by identifying and negotiating development of ten priority regulations needed for licensing these facilities.

PNNL participated as an active team member of NN-60's Monitoring and Inspection working group. This working group accesses, in conjunction with other national laboratories, PNNL's considerable expertise in remote monitoring and inspection capability to help establish the strategy for verification of the disposition of excess, weapons grade material. This contribution is viewed as key to the successful implementation of the bilateral Pu disposition agreement.

## Office of Intelligence (DOE-IN)

PNNL is a principal provider of analytical and technology products for DOE's Office of Intelligence (IN) and related work for other federal organizations.

Evaluation of PNNL's performance by DOE/IN during FY2001 considered:

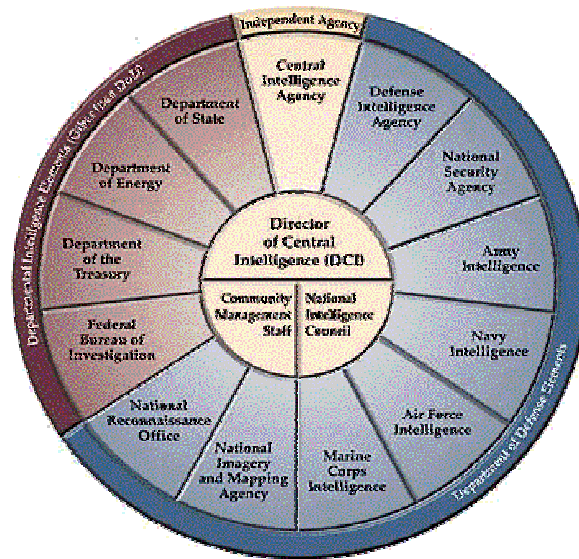
1. Technical, analytical and programmatic support by PNNL staff on-site and detailed to DOE-HQ/IN in Washington, DC, and
2. Analytical, research & development, and operational support by PNNL Richland staff for DOE/IN programs [including operation of the Field Intelligence Element (FIE) and associated Sensitive Compartmented Information Facility (SCIF)].

PNNL's Special Program Sector, in which this business resides at the Laboratory, conducted a self-assessment of current performance during the fourth Quarter FY2001 and provided that as input to performance discussions with the Director (IN-1).

An interview conducted with IN-1 on September 11 (interrupted by the terrible events of that date) yielded the following partial interview comments:

PNNL continues to perform in an overall outstanding manner in support of DOE's Office of Intelligence (IN). PNNL's analytical products routinely go directly to the Energy Secretary; the Administrator, NNSA; the DOE Assistant Secretaries; and the National Security Council thereby having a direct impact on national security and policy decisions.

The Director also indicated that PNNL staff detailed to DOE/IN and based in Washington, D.C. continue to provide an irreplaceable level of technical quality not available elsewhere in the federal government. Our analytical products, as well as our science and technology products, continue to provide DOE/IN and its other federal government customers an **Outstanding** level of support.



### 1.1 Quality of Science and Technology

The **Outstanding** quality of the Science and Technology we delivered to DOE/IN and related customers in FY2001 is best reflected by the following highlights of achievements:

- ♦ **Analytical Products.** PNNL continues to be the principal technical contributor to IN analytical programs by virtue of our technical staff here in Richland and those assigned to DOE/IN



in Washington, DC. In addition we have achieved national recognition within the Intelligence Community (IC) this year for start-up and coordination of a multi-Lab, multi-agency special purpose analytical center. This has been accomplished while maintaining our traditional leadership role in providing in-depth nuclear technical intelligence products across the spectrum of Community interests. Most notably, these include the highly regarded Site Reports, Fuel Cycle Analyses, World-wide Nuclear Power Assessments, World-wide Radwaste Assessments, and requests for direct PNNL technical support to other agencies.

- ♦ **Technical Integration Center.** PNNL opened its special purpose **Technical Integration Center (TIC)** in the Washington, D.C., area in early FY2001 for special analyses supporting DOE/IN and Intelligence Community interests; PNNL has been asked to expand the role this center supports to meet similar DOD needs in FY2002. We anticipate this expansion, based on analytical successes in FY2001, will become a multi-million dollar research activity in FY2002.
- ♦ **Western Regional Information Science Research Center (WRISRC).** The Advanced Research & Development Activity (ARDA), a new IC resource office, designated PNNL as the site for its **Western Regional Information Science Research Center (WRISRC)** in the second half of FY2001; The Center will focus initially on network-centric “challenge problems” in FY2002 and will have participation from other DOE National Laboratories, the IT industry, and universities in the western United States. We anticipate the funding of approximately \$1 million/year to start.
- ♦ **IN Lead For Non-nuclear Energy Analysis Initiative.** One measure of IN’s great confidence in PNNL contributions was IN-1’s direct request for PNNL to lead a new non-nuclear (e.g., oil and gas) energy industry assessment as a new analytical thrust within DOE/IN for FY2002 and beyond.
- ♦ **Nuclear Site Reports.** We continue to provide quarterly analytical updates to the nuclear facilities site reports - one of our secure on-line products for DOE-HQ/IN. As part of that program

we have been able to maintain and strengthen PNNL’s legacy nuclear science and engineering talent to providing effective technical intelligence analyses on nuclear related topics. As part of this program we hosted visits twice for IN Division chiefs and staff and provided an annual program review to IN-1 on the full scope of analytical products produced for IN. The Nuclear Nonproliferation Division (NND) representative continued to praise our performance during the annual program review in April 2001.

- ♦ **A Successful Classified Laboratory Directed Research and Development (LDRD) Transition.** Successful conclusion of a classified LDRD has led to FY2001 funding from a Division within IN which we have not previously supported in prior years. The breakthrough in this new area of analysis was based on the quality and uniqueness of the ideas developed over the last two years of LDRD investigations, including technical liaison with other national laboratories. This marks the first time LDRD has been applied in support of an IN analytical topic.
- ♦ **Continued Strong Contributions To The DOE Special Technologies Program (STP).** PNNL demonstrates continued leadership by broadening its participation in DOE IN’s Special Technologies Program by providing high-quality proof of concept prototypes or demonstrations in support of DOE/IN’s Special Technologies Program (STP). Products provided by PNNL staff demonstrate concepts reflecting their significant expertise and experience. We are particularly recognized as DOE’s and the IC’s core experts in niche areas, including, but not limited to Information Technologies (IT). PNNL continues to broaden its interactions with the other member agencies of the IC through IWFO (Intelligence Work for Others) projects that meet customer needs and are provided on time and on budget. We provide assistance to STP in the development and modifications to their annual requirements calls, Technical Assessment Panel (TAP) participation/role, and drafting the annual budget plan. We also have provided assistance to STP in the development of their strategic plan.

## 1.2 Relevance to DOE Mission and National Needs

The relevance of our work to DOE Missions and needs is best articulated through the results presented below and reflect **Outstanding** performance.

**Senior Staff Assignments To The Intelligence Community.** PNNL continues to expand its support to the Intelligence Community as requested by several agencies to continue or to fill new Interdepartmental Personnel Assignments (IPA) with key senior PNNL staff. Among these are staff in IPA positions at the National Intelligence Council (NIC), the Central MASINT Office (CMO), the CIA and the Office of the Secretary of Defense (OSD).

**Special Technologies Program (STP).** PNNL has and plans to continue playing a leadership role as one of four principal Laboratories supporting the Special Technologies Program. As measured by other federal funding attracted to support follow-on work to budget-constrained STP-funded projects, PNNL continues to show outstanding return on DOE funds invested at PNNL. That trend is continuing in FY2001 based on our key technical innovations as acknowledged by external government advocates for projects such as the Sensor-Detector, Internet Characterization Tools (ICT), and Hardware Vulnerability projects.

**FIE Operations Support Broad Range of DOE Missions.** PNNL continues to serve as the model FIE for compliance with DOE/IN policies, DCID interpretation and E.O. 12333 requirements. We provide direct support to DOE IN-1, DOE CN-1, the Community Management Staff (CMS) and the Justice Department on implementation of DCID 1/7 and E.O. 12333 through our staff assigned to DOE/IN. We also provide support directly to the other FIE's in the DOE system in training to these requirements. PNNL is developing a greatly enhanced SCIF Operations SOP that will serve as the example and guide for other FIEs in the DOE National Laboratory system.

## 1.4 Effectiveness and Efficiency of Research Program Management

The **Outstanding** nature of our research program management is supported by highly effective operation of secure facilities supporting IN and related work and our planning for future facilities supporting expansion of that work. Key performance indicators include:

**FIE/SCIF Operations.** PNNL continues to set the standard for compliance with E.O. 12333, DCIDs, and DOE/IN Directives for operation of the Field Intelligence Element and the associated SCIF. A recently completed Security Assessment by DOE-HQ staff resulted in only four minor findings, which were immediately resolved. No additional follow-up actions were noted. We also completed installation of a new TS/SCI-level video teleconference capability to support communications with DOE/IN, other DOE National Laboratories, and other IC sites equipped with compatible systems.

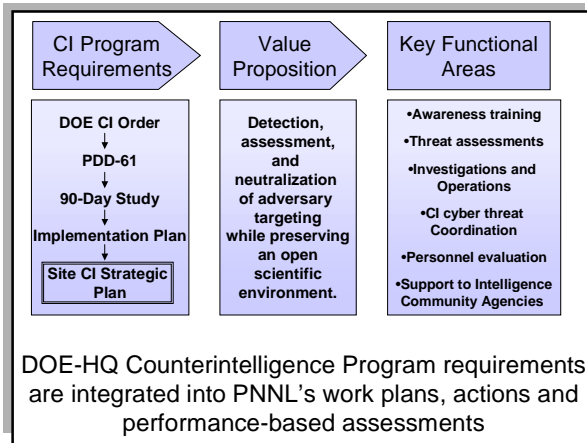
**PNNL Approves SCIF Expansion.** With the continued growth in both DOE and IWFO analysis tasks during FY2001 and forecasted growth in FY2002 and beyond, the Special Programs Sector has initiated an investment plan in FY2001 for expanding the area of our current SCIF from about 1,900 sq ft to 8,250 sq ft. This will resolve overcrowding and improve access for staff supporting IN and related work-for-others programs for more cost-effective operations. Initial engineering design and cost estimates were performed in FY2001 with plans for completing construction in the latter half of FY2002. This expansion has been encouraged and supported by DOE/IN.

## Office of Counterintelligence (DOE-CN)

The ultimate indicator of our performance to CN continues to be their satisfaction as a customer. The **Outstanding** nature of our performance in this regard is again demonstrated by the "outstanding" performance feedback we continuously receive from the CN Director during frequent conferences at Washington, DC.



The PNNL CI Organization Strategy is depicted in the following chart.



During FY2001, PNNL continued onward toward its long-range objective to develop a **comprehensive and balanced** Counterintelligence (CI) program that services all components within the Laboratory. The program also evolved during FY2001 to its optimum level of function area **integration**. Its defined mission, or value proposition, is to both enhance DOE national CI program objectives and to support the local scientific community through the detection, assessment, and neutralization of foreign intelligence services and organizations that are targeting Laboratory personnel, technology, facilities, and activities. During FY2001, the PNNL CI Organization made outstanding strides in achieving that mission by focusing efforts in attaining an effective and efficient operation founded equally on the six DOE-CN key functional areas of Counterintelligence: awareness and training, threat and risk assessments, investigations and operations, CI cyber security, personnel issue evaluation, and support to Intelligence Community agencies. It utilized a team approach to address these CI key function areas through coordinated collaborations with other DOE CI resources at the Lab and Hanford Site, and liaison initiatives with the FBI and other intelligence and law enforcement agencies. The CI Program's balance and integration of objectives and priorities was formally defined in a uniquely drafted Strategic Plan and planning process that was refined and formally tested during FY2001. That process was designed to be regularly assessed

and updated on a performance (not compliance) standard, thus driving this Program to achieve the stated expectations of the CN Director as well as the needs of our Lab and Hanford scientific and technical staff that is communicated through their institutional plans. As a result of their efforts, the expert and dedicated staff assigned to PNNL's CI Organization continue to be highly regarded by DOE's Office of Counterintelligence (OCI) managers and its partner agencies within the Intelligence Community.

### 1.1 Quality of Science and Technology

Through an effective CI Program, the integrity and reputation of the local scientific community is enhanced to a degree that positively impacts the latter's success. The **Outstanding** quality of the Science and Technology we deliver to our customer is best reflected by the results we have achieved in the six key functional areas noted above, the highlights of which are summarized below:

- ♦ Executed three of DOE-CN's largest programs (Polygraph, Inspection, and Cyber) utilizing the most sophisticated of the Lab's intellectual and scientific capabilities
- ♦ Addressed traditional CI issues through a strategy centered on "audience specific" group briefings/debriefings oriented toward major Lab programs, threat analysis processes designed to support (not curtail) scientific initiatives, and measurement through the evaluation of staff reports and professionally conducted investigative/operational responses to reported CI anomalies.
- ♦ Developed during the course of FY2001 a CI cyber security workforce fully integrated and supportive of all key functional areas associated with the traditional CI work scope.

### 1.2 Relevance to DOE Missions and National Needs

The relevance of PNNL's CN efforts to DOE Missions and needs is best articulated through the results presented below and reflect **Outstanding** performance.

- ♦ PNNL continues to directly impact DOE's goal of protecting sensitive information and technologies from foreign exploitation, particularly through specific analytical projects developed in collaboration with the staff of the DOE-CN Director
- ♦ All programs are maintained and implemented across the DOE Complex and tightly linked to Federal Law Enforcement and Investigative Agencies
- ♦ PNNL acts as the primary deliverer of technology supporting CN's national efforts to address intrusion detection and analysis

#### 1.4 Effectiveness and Efficiency of Research Program Management

The **Outstanding** nature of our research program management continues to be demonstrated by the "outstanding" performance feedback continuously received during meetings with the CN Director.

- ♦ Successfully completed during FY2001 the consolidation of the PHMC CI function into a unified program managed singly by the PNNL CI Office
- ♦ Exported the unique Strategic Plan and planning process developed at PNNL for incorporation into other Lab and Operations Office CI Programs, including those at Sandia, Livermore and Los Alamos National Laboratories.
- ♦ Completed the Lab's most extensively researched local CI threat assessment

### Energy Mission

The Laboratory's Energy Mission area contributes to the Critical Outcomes through the development of knowledge and technology aimed at solving some of the nation's most pressing energy generation, energy efficiency and environmental quality issues. With respect to the DOE's R&D Portfolio, which outlines DOE's approach in addressing the principal national energy R&D issues, PNNL contributes critical science and technology to the following areas:

- ♦ The development of clean and efficient vehicle technologies

- ♦ The development of new advanced power systems
- ♦ The development of new technologies for efficient and affordable buildings
- ♦ The development of technology for efficient and productive industrial energy use

In the development of the Laboratory's Energy strategy, the Energy leadership team establishes strategic goals and objectives, and matches those with capability and program development activities organized as focused multiyear technical thrusts. Energy thrusts are aimed at supporting major new programs from EE/RE and FE, generally in the form of collaborative R&D programs with industry. The Directorate aims to simultaneously develop key technical capabilities that align PNNL's long-term technical agenda with DOE's R&D portfolio, and to further aid DOE in lowering the technical risk to U.S. industry in the adoption and implementation of energy efficient technologies through our technical work.

The Energy Mission is taking the following actions on behalf of the Laboratory to achieve performance toward the Laboratory's Critical Outcomes:

1. Providing DOE EE/RE and FE with leadership and organized industrial participation in programs involving technologies in energy generation and energy utilization. Targeted industrial sectors include:
  - ♦ Automotive and heavy truck manufacturers and suppliers
  - ♦ Advanced energy system developers
  - ♦ Building technology and equipment manufacturers
  - ♦ Energy intensive manufacturing and processing industries
  - ♦ Integrated alternative (bio-based) value based energy and chemical products
2. Attaining leadership roles with the Assistant Secretaries for EE/RE and FE in targeted DOE initiatives:
  - ♦ Solid-State Energy Conversion Alliance (FE)
  - ♦ Northwest Alliance for Transportation Technology (EE)



- ♦ 21<sup>st</sup> Century Truck (EE)
  - ♦ Multi-Laboratory Heavy Vehicle Emissions Reduction Program (EE)
  - ♦ Carbon Management and Carbon Capture and Sequestration (SC/EE/FE)
  - ♦ BioEnergy/Agricultural Industry of the Future (EE/FE)
3. Establishing PNNL as a thought leader in DOE programs through strategic hiring of recognized leaders in key technical fields. Key hires have been added to staff in the following areas in FY2001:
- ♦ Photonic and Electro-optic Materials (1)
  - ♦ Electrical Transmission and Grid Reliability (1)
  - ♦ Fuel Cell Technology (4)
  - ♦ Bio-based Products and Processes (1)
4. Establishing growth in key EE/RE and FE programs through technical excellence in research and development, with particular emphasis in technical thrust areas:
- ♦ Light Weight Automotive and Heavy Truck Structures
  - ♦ Solid-Oxide Fuel Cell Systems for Automotive/Truck Applications and Stationary Power Generation for Distributed Power
  - ♦ Diesel Emissions and Aftertreatment Technology
  - ♦ Bio-based Products and Processes
  - ♦ Energy Systems and Grid Reliability Technology
  - ♦ Computational Engineering and Simulation
  - ♦ Carbon Management and Carbon Sequestration

The implementation of the Energy Directorate strategy currently revolves around the activities in six active thrust areas. These thrusts have been selected for long-term program development and capability investment on the basis of being critical to DOE missions, having high potential for national leadership roles for PNNL, and for their importance in supporting and underpinning the Laboratory's technical competencies in the energy

arena. In addition to the activities within thrust areas, there are numerous other dimensions to strategy development and management of ongoing programs that are covered outside the context of these thrusts. The six active thrust areas are:

**Advanced Fuel Cell Technology Thrust** – This thrust was established in mid-FY1998 to build on the long-standing PNNL strength in fuel cell materials research, and it aligns the Laboratory's technical capabilities with the DOE R&D agenda for the development of high efficiency advanced energy systems. The thrust expands the Laboratory's niche capabilities in ceramic materials and solid-oxide fuel cell component technologies into a systems engineering framework. The long-term outcome of the thrust will be to establish PNNL as a preeminent institution in the design, development and demonstration of advanced planar designs of SOFC technology, and to aid industry in the transition of that technology into cost effective power systems for both transportation and stationary applications.

**Lightweight Transportation Materials Thrust** – The Lightweight Transportation Materials thrust began in FY1997 and was designed to expand PNNL strengths in materials science, metallurgy, and computational engineering. Specifically, the thrust was aimed at expanding capabilities and industrial relationships in lightweight automotive structure development, created during the 1990's under EE/OTT/USCAR PNGV programs. The expansion of the technical agenda was aimed at providing solutions to a host of cost and manufacturing process issues that have inhibited the auto industry from adopting light metal structures for mass-produced vehicles. The thrust formed the technical basis of a joint DOE/OTT and PNNL initiative called the Northwest Alliance for Transportation Technology (NATT). The goals and objectives of NATT and the Lightweight Transportation Materials thrust align with the DOE R&D agenda in the development of clean and efficient vehicles. The focus of this thrust is presently expanding from light metal automotive structure applications into light truck/SUV and heavy vehicle applications.

**Advanced Energy System Thrust** - The Advanced Energy System Thrust began in FY2001 and will employ innovative new computing and telecommunications technologies to increase the connectivity and information flow throughout the energy system to enhance energy system reliability, cost performance and integrity. Devices from large generating plants to small appliances will send and receive the information they need, communicating the price and value of a broad and dynamic set of energy commodities in near real-time. Grid-friendly appliances and equipment, distributed generation and storage, and open markets for the fuel, central generation, and electric transmission and distribution all demand that the fragmented, linear networks of the present be replaced by a new generation of controls and networks designed to enhance both local and global optimal performance, driving out inefficiencies, enabling strong markets, and creating a more dynamic, healthy system.

**Computational Engineering and Simulation Thrust** - High performance computational scientific and engineering modeling has been identified as a critical success factor for PNNL and is a specific area for expansion with respect to public and private energy programs. This thrust area combines high performance computing, advanced applications in computational engineering/materials science, and targeted development of simulation methods and design tools to support other thrusts and initiatives. Other supported thrusts and initiatives include the fuel cell technology thrust, lightweight automotive materials thrust, automotive and truck emissions system development, the Advanced Computational Sciences Initiative, and a host of industrial technology applications key to DOE's Energy R&D agenda. The aim of the thrust is to develop staff capabilities and make key and strategic hires to significantly improve the overall technical acumen of our staff, as well to provide state-of-the-art computing facilities and engineering software for use in various new applications.

**Carbon Management and Carbon Sequestration** - PNNL has maintained national leadership in several areas of the Carbon Management agenda for the past decade. Driven by increasing interna-

tional attention on the climate change issue, and in good measure by the work of PNNL in this area, the Administration, Congress and DOE have begun to recognize the significant role that technology can play in addressing climate change. This has resulted in PNNL being asked to take on an integrating role in the National Climate Change Technology Initiative. The investments made by PNNL and DOE programs have enabled us to develop the tools, knowledge, and scientific data necessary to assess benefits and potential impacts in the implementation of various technologies to reduce carbon emissions. Carbon capture and carbon sequestration are topics of increasing importance relative to new technology development and demonstration programs in the EE and FE portfolio. PNNL and Battelle are actively helping DOE develop new national initiatives around these topics.

**Bio-based Products and Bioprocesses** - The thrust and Laboratory initiative in this area is aimed at developing an integrated portfolio of innovative chemical, biological, and supporting process technologies and supporting equipment and facilities that will enable financially attractive enterprises for production of chemicals and materials from renewable biomass resources. Further, we seek to secure leadership roles for PNNL in several growing DOE programs, to develop the extensive industrial relationships required to significantly impact DOE programs through cooperative government-industry programs. This thrust builds upon an existing strong capability in condensed phase catalysis and filamentous fungi expression. PNNL is recognized for application of this capability to make several higher-value chemicals from crop-derived sugars and fermentation-derived organic acids, and has established early leadership in DOE/EE biomass-to-chemicals programs. Maintaining this leadership requires investments to enhance PNNL's capabilities, both in chemical processes (the current area of strength being catalysis) and in entirely new biological and supporting processes.

Our progress in these thrust areas as well as on the key actions we have identified demonstrates **Outstanding** performance as recognized by increasing leadership roles with EE and FE programs in each of the thrust areas.

Many of the indicators we use to determine our level of performance and predict how our customer will view our performance transcend one or more of the four key objectives identified in the Performance Evaluation and Fee Agreement. For that reason, our results are presented instead in sections. Each section title describes, to the degree possible, the key objective or objectives to which the indicators correlate. For example, evidence of the effectiveness and efficiency of our research program management in this mission area is provided in both the section discussing quality as well as relevancy. The section headers are meant to denote this fact. It should also be noted that the Objective entitled, "Success in Constructing and Operating Research Facilities," is not applicable to this mission area.

## Office of Fossil Energy (FE)

### 1.1 Quality of Science and Technology and Effective Program Management

The Laboratory's **Outstanding** progress toward this objective is exemplified by several significant accomplishments developed within our key thrusts, specifically that of the Advanced Fuel Cell Technology.

The various fuel cell programs managed by the Office of Fossil Energy have provided funding to PNNL over a period of more than 15 years. These programs have been largely focused on basic physical properties, chemistry and ion transport phenomena for the materials used in various solid-oxide fuel cell designs. This long-standing research foundation in basic materials chemistry, solid-state physical inorganic chemistry, electrochemistry, and metallurgy combined with a considerable depth in ceramics, gave rise in FY1999 - FY2000 to an opportunity to help develop and manage a new national fuel cell program supported by FE. This program, organized under a government/industry collaborative partnership called the Solid-State Energy Conversion Alliance (SECA), focuses on the development of practical and cost effective modular designs of planar solid-oxide fuel cell systems.

In anticipation of the changing direction of FE's fuel cell program the Energy Directorate formulated a technical thrust with an associated capability development initiative aimed at advanced fuel cell technology. The thrust was designed to expand our basic chemistry and materials research capabilities into a program in integrated SOFC stack design, fabrication and testing. In FY2000, PNNL began a Laboratory-level LDRD initiative in fuel cell development. Late in FY2000, programmatic funding was initiated at PNNL in the form of the SECA Core Technology Program, which will integrate SOFC research at the DOE National Laboratories and Universities in support of SECA's industrial teams. The SECA Core Program funding level was increased in FY2001 and will eventually claim 40% of the total SECA funding, targeted at our goal of a \$50M energy business by 2003.

To date, significant technical outcomes have been achieved in these programs and these can be used to highlight the Laboratory's outstanding performance in the execution of research over this relatively short period of time. These accomplishments include:

- ♦ The conceptualization, fabrication and testing of new planar solid-oxide fuel cell designs which produce state-of-art power densities, are designed for high cycle-ability, low thermomechanical stress, and incorporate materials and component designs which have lead to unprecedented stability and robustness of these high temperature fuel cell stack systems.
- ♦ The development of computational modeling tools for the design, optimization and fabrication of advanced planar fuel cells. These tools and computational methods represent forefront applications for the design optimization of planar solid oxide components as well as state-of-the-art models of electrochemical behavior, thermal performance, fluid dynamics, and thermomechanical behavior within the very complicated materials set used in these systems. Technical achievements include:
  - Computational fluid dynamics models and methods to evaluate air and fuel flow through the stack system and thermal transport

- Finite element models and tools to assess stress and thermo mechanical behavior of materials in these high temperature applications
- Electrochemical modeling to assess issues of heat generation, fuel utilization and optimum configuration of active surfaces

Further achievements in fuel cell development are associated with the demonstration and testing of multi-cell stacks, and performance evaluation of the technology during thermal cycling. Other significant technical advances have been made associated with the development of new materials for electrodes which are chemically stable in oxidizing and reducing environments and demonstration of forefront catalytic microchannel fuel reformation technology for fuel cells, supported by EE/OTT.

Overall, the Energy Division views the technical quality of PNNL's contributions in fuel cell research to be Outstanding and an excellent example of the Laboratory's ability to quickly adapt its research agenda to changing DOE mission needs.

However, there are numerous challenges to overcome in our future research activities as SECA broadens its agenda and incorporates other national laboratories and industrial teams. Principal among anticipated challenges will be the incorporation of design engineering rigor to our approach in developing and evaluating fuel cell systems. We have incorporated an aggressive program to make several strategic hires to aid in our transition to systems-level integration of fuel cell technology. Key hires were accomplished in FY2001 in several areas of fuel cell science and related technology including metallurgy, electrochemistry and ceramics.

## 1.2 Relevance to DOE Mission National Needs and Effective Program Management

The relevance of our research to DOE mission needs is best illustrated through our activities in developing new programs in collaboration with our DOE program counterparts and demonstrates **Outstanding** performance. We are extremely active in creating new program opportunities for the national laboratories in the energy arena. This is a

reasonably complex challenge given the programmatic imperative for industrial collaboration involving the bulk of EE/RE and FE programs.

In FY2000, the Laboratory initiated an important national program development activity in collaboration with our DOE FE Energy Mission client. This activity was the development of the Solid-State Energy Conversion Alliance (SECA) with FE. SECA represented a new government/industry collaborative research program in fuel cell technology development, which PNNL and NETL will co-manage. In FY2001, PNNL and NETL's management teams have expanded the SECA program through program solicitation and evaluation of industrial proposals to develop cost effective, mass manufacturable fuel cell systems. Four industrial awards under SECA have been made in FY2001 totaling nearly \$270M over 10 years. While this activity is not the sole concern for the Laboratory in renewing our programs and insuring their relevance to DOE missions, it provides a good illustration of the importance and impact of the Laboratory's contribution in guiding the programs in the DOE portfolio.

The Laboratory is currently fostering several technical thrusts and Laboratory initiatives that will be important additions to our FE programs in the future including Carbon Management and Carbon Sequestration, and a distributed generation focus as it relates to advanced energy systems development.

### Creating Relevant Programs for the Office of Fossil Energy: Solid-State Energy Conversion Alliance (SECA)

During the middle portion of the 1990's, the Office of Fossil Energy suffered through significant decreases in its research and development program budgets. In response to heavy congressional criticism of its programmatic content, FE's management team formulated a new strategy aimed at developing the next generation of forefront technologies for clean and affordable power production from fossil fuel feedstocks. This strategy was known as Vision-21, and while heavily modified relative to the initial versions of the document, Vision-21 remains the strategy framework for FE programs.



In FY1999, FE leadership requested of PNNL aid in rethinking its technical approach within its fuel cell programs in order to gain a better level of consistency with Vision-21 goals. In the process of providing technical assistance to FE, it became apparent to PNNL that congressional support for ongoing fuel cell research was extremely weak without a serious commitment by FE and industry to aggressively pursue a practical and cost effective implementation of the technology. During the latter months of FY1999, the Laboratory's Energy Division, and BMI's Commercial Automotive and Energy Sectors initiated discussions with industry to probe interest in the most promising of the fuel cell technologies, those based on Proton Exchange Membrane (PEM) technology and solid-oxide (SOFC) technology. These discussions resulted in the generation of a level of consensus among the Energy leadership that a new approach to SOFC technology would generate a high degree of interest in industry and in congress. The approach was one based on firm cost constraints for the initial capital cost per unit energy, and the manufacture of the technology through mass customization and modular design. These ideas were formulated into a proposition to FE and NETL for the creation of a new SOFC program organized around vertical industrial consortia not unlike the structure used in the OTT NATT program.

As a result, the Solid-State Energy Conversion Alliance (SECA) has been developed as a public/private alliance, organized and managed by FE/NETL and PNNL, funding advanced fuel cell technology in the development of the next generation of low cost solid-oxide fuel cell systems. These systems are targeted on the transportation, mobile/military power and stationary power markets. The organization of SECA is consistent with the following:

- ♦ SECA and its national laboratory and industrial technical teams are governed by a collaborative development agreement between DOE and a set of systems developers (industrial teams) that have committed to commercial deployment of a common fuel cell module adapted for specific targeted markets, system costs, and common specifications.

- ♦ DOE and other participating Federal agencies are joined through a Memorandum(s) of Agreement committing to co-funding development and a common commitment to overall management by DOE Fossil Energy.
- ♦ FE/NETL serves as the executive – managing member for the alliance, acting on behalf of all the Federal agencies engaged in SECA.
- ♦ PNNL and NETL will co-manage a horizontal core technology program based at the DOE national laboratories and universities, the aim of which is to provide technology solutions to all members of SECA for common materials and subsystem components challenges.

NETL will manage SECA's initial four industrial teams and other industrial teams as they are added in FY2002 and beyond. PNNL will manage and coordinate the base or core technology development programs located at the national laboratories and universities in support of the SECA industrial teams. The Core Technology Program will eventually grow to be approximately 40% of the SECA budget.

SECA was launched on June 2, 2000 through an industry workshop in Baltimore, Maryland, organized by PNNL and NETL. The workshop introduced the working assumptions of SECA to 250 interested industrial, national laboratory, and university researchers. The meeting was also designed to develop a consensus on the technical barriers which would have to be overcome in order to achieve SECA's long-term goals. A second annual SECA meeting, held in April 2001 in the Washington D.C. area, drew a much wider attendance and focused on current technology projections for fuel cell development, market needs, and future program solicitations under the SECA banner. Subsequent to this meeting, NETL announced four initial SECA industrial awards to Westinghouse/Siemens, Delphi, Honeywell and Cummins totaling nearly \$271M over the next 10 years.

The development of the SECA concept and program plan was funded from NETL program management and planning funding with \$2.8 million in support to PNNL in FY2000 and \$3.2M in FY2001. FY2002 funding for SECA is estimated

to be between \$21M and \$28M. PNNL's funding for FY2002 is anticipated to be between \$3.5M and \$4.0M for SECA Core Program and other FE fuel cell programs, demonstrating Outstanding performance.

## Office of Energy Efficiency and Renewable Energy (DOE-EE/RE)

### 1.1 Quality of Science and Technology and Effective Program Management

The Laboratory's **Outstanding** progress toward this objective is exemplified by several significant accomplishments developed within our key thrusts, specifically within the Lightweight Transportation Materials thrusts.

In 1997, in partnership with the EE/RE Office of Transportation Technology (OTT), PNNL set out to form the Northwest Alliance for Transportation Technology (NATT). The objective of NATT was the linking of research capabilities within the national laboratories and universities with the automobile industry and light metal producers. This research alliance was formed in an effort to lower the cost and manufacturing process barriers in the incorporation of aluminum and other light metals into the mass production of automobiles. Over time, the scope of NATT has evolved and now includes research and development in a broad range of technologies in addition to light metal structures, including diesel emissions reduction technologies and automobile glass manufacturing processes.

During the initial phases of NATT, programs included research in technologies to reduce raw materials cost for automotive applications, development of advanced forming processes that allow for lower manufacturing cost for complex structures, and technologies that enable the incorporation of more aluminum, magnesium, and composite materials to automotive systems.

There are numerous examples among the technical outcomes from the initial phases of the NATT program that provide good illustrations of techni-

cal excellence. Those that have resulted in significant outcomes during the past year include:

#### **Development of a process technology for the continuous thermal reduction of magnesium:**

- ♦ NATT and Alcoa have participated in a major effort to develop a revolutionary new low-cost process for the production of primary magnesium.
- ♦ The process has the potential of reducing the cost of magnesium by as much as 25%
- ♦ The technology would position Alcoa as the world's low-cost producer of magnesium
- ♦ Pilot scale demonstration is currently underway
- ♦ Will produce positive and significant impacts for the cost effectiveness for magnesium incorporation in automotive and truck structures.

#### **Development of lightweight automobile glass and manufacturing process methods:**

- ♦ A highly successful collaborative project with PPG and Visteon Automotive Systems
- ♦ Developed advanced measurement technologies for glass properties, stress and strength evaluation
- ♦ Use computational modeling was to develop predictive analytical tools for design
- ♦ Resulted in 30% weight reduction in windshield and side body glasses
- ♦ Technology meets targets for structural integrity, cost, and crash worthiness

#### **Lightweight Pick-Up/Sport Utility frame development:**

- ♦ One half of all new vehicle sales in the U.S. are light trucks (PU), sport-utility vehicles (SUV) and vans
- ♦ NATT recognized the need for weight reduction technologies for PU/SUVs and funded studies to determine the feasibility of building a lightweight aluminum frame for PU/SUVs
- ♦ Lightweight frame of aluminum and steel will significantly reduce the vehicle weight at very low cost penalty



- ♦ NATT is now in the process of funding the optimization of the design and fabrication of actual vehicle prototypes

In addition to these light metal and lightweight automobile structure projects, PNNL is recognized as a leading developer of basic science and application technology in automobile emissions reduction technology and fuel reformation systems for transportation applications.

We believe that PNNL's leadership in NATT and the technical progress made in these programs represents an **outstanding** contribution to the automotive manufacturing and light metal process industries. These accomplishments represent important technical outcomes in support of DOE's Energy Mission. The challenges faced by PNNL and its management in the next phases of the Laboratory's thrust in lightweight transportation materials are associated with aligning with the needs of the heavy truck manufacturing industry. This is due in large part by the formulation of a new multi-agency initiative in truck technology, dubbed 21st Century Truck, the technical agenda for which will converge with that of NATT under EE/RE Office of Transportation Technology leadership. PNNL accomplished one strategic hire in the area of heavy truck and emissions reduction technology in support of NATT and 21<sup>st</sup> Century Truck in FY2000. This individual is detailed to OTT/Office of Heavy Vehicle Technology for program development activities. An additional hire in this area is scheduled for November 2001.

Within the Office of Transportation Technology agenda in FY2001, there were several significant changes in focus. The most significant of which was the increased emphasis on emissions, in particular, those associated with diesel emission from heavy vehicles. While the agenda and funding future for 21<sup>st</sup> Century Truck are still in formative stages, the technical program within the Office of Heavy Vehicle Technology (OHVT) has been retooled with the help of PNNL management and others such as ORNL and SNL to begin a new program designed to address aftertreatment technology for diesels. New regulatory requirements will necessitate a 90% reduction of NO<sub>x</sub> and

particulate emissions by 2007, a goal which is unattainable through the use of present emissions technology.

A new program has been initiated within OHVT called the Multi-Laboratory Heavy Vehicle Emissions Reduction Program. Within this program PNNL will lead the Essential Power component and will contribute to the aftertreatment program through our long-standing diesel emissions programs.

## 1.2 Relevance to DOE Mission National Needs and Effective Program Management

The relevance of our research to DOE mission needs are best illustrated through our activities in developing new programs in collaboration with our DOE program counterparts and demonstrates **Outstanding** performance. We are extremely active in creating new program opportunities for the national laboratories in the energy arena. This is a reasonably complex challenge given the programmatic imperative for industrial collaboration involving the bulk of EE/RE programs.

In FY2000 and FY2001, the Laboratory's Energy Division developed important national program development activities in collaboration with our DOE-EE/RE and FE Energy Mission clients. These activities are the continued development of NATT with EE/RE OTT into its next phase, heavy truck technology, and development of the programmatic relationship between NATT and a multi-agency initiative, 21<sup>st</sup> Century Truck, continued efforts to focus attention and programmatic support in Carbon Management and Carbon Sequestration with EE/RE, FE and SC, and new concepts and technology development in advanced energy systems with EE and FE. While these activities are not the sole concern for the Laboratory in renewing our programs and insuring our relevance to DOE missions, they provide a good illustration of the importance and impact of the Laboratory's contribution in guiding the programs in the DOE portfolio. The Laboratory is currently fostering several lower-level thrusts and Laboratory initiatives that will be important additions to our EE/RE programs in the future.

## Creating Relevance in Office of Transportation Technology Programs: The Evolution of the Northwest Alliance for Transportation Technology

Working with the Office of Transportation Technology, NATT has funded over 50 projects in lightweight metal forming and emission reduction technology since its creation in 1997. Spearheaded by PNNL, NATT was originally organized around technical goals that aimed to develop practical metal processing technology. These technologies were focused on enabling the automobile manufacturers to more easily and cost effectively introduce light metal structures into mass produced vehicles. The projects funded by NATT over the first three years have involved researchers from industry, national laboratories and universities, and NATT is responsible for developing valuable technology and aiding in reducing the cost in various manufacturing operations. It is worth noting that these projects are peer reviewed by DOE and industry to demonstrate progress and relevance to the overall objective of increased vehicle fuel efficiency and reduced emissions.

NATT and the associated PNNL OTT programs have made several important transitions during the past year. NATT, as a program with active automobile manufacturer and supplier contingents, has demonstrated its viability as an ongoing budget item within OTT through the support and enthusiasm of the industry participants and DOE management. PNNL and OTT management are supportive and cooperative relative to the program goals, objectives and project funding levels. In addition, PNNL Energy Division managers actively participate in OTT priority setting workshops and road mapping exercises associated with PNGV and heavy truck programs.

At the outset of FY2000, NATT faced some significant challenges associated with its mission. PNGV has become a mature program area with declining budgets in areas where NATT provides significant support. As well, a large portion of the first phase of projects within NATT were moving into the terminal stages of funding and new projects and technical goals were needed. In response, PNNL management and key technical

staff have become involved in the formulation of strategy within a new multi-agency initiative called 21<sup>st</sup> Century Truck. It is anticipated that DOE OTT will become the managing organization for this initiative within the Federal Agencies. PNNL has engaged Northwest heavy truck manufacturers PACCAR and Freightliner in dialog about energy efficiency needs surrounding heavy truck technologies, and along with Detroit Diesel and Caterpillar, PNNL has developed new NATT and OTT programs in heavy truck emissions reduction technology relevant to OTT goals, as well as those of 21<sup>st</sup> Century Truck.

The aim of our Energy Mission area is to aggressively evaluate the relevance and impact of its science and technology programs on a regular basis. The Sector makes concerted efforts with its DOE clients to redeploy those capabilities and program funds when opportunity exists for new and significant contributions to the DOE Mission outcomes. The Program development activities associated with OTT/NATT and the FE/SECA are excellent examples of dynamic program development in DOE and PNNL's best interest.

The overall performance rating for this Critical Outcome is determined by comparing the Total value in Table 1.1 below, to the rating scale in Table 1.2.

## Major Laboratory Initiatives

### 1.5 Create Leading-Edge Scientific Capabilities to Support Evolving DOE Mission Needs

#### Results

Three initiatives, Biomolecular Networks Initiative (BNI), Computational Sciences and Engineering Initiative (CSI) and Nanoscience and Nanotechnology Initiative (NNI) comprise the Lab's effort to create leading-edge scientific capabilities focused toward advancing fundamental knowledge in biological, information, and physical sciences. Overall, BNI, CSI and NNI made **Outstanding** progress. In addition to achieving our highest performance expectations the initiatives made significant progress in many other areas.

This year has been one of significant progress in building the *Biomolecular Networks Initiative* research program, our internal capabilities, and our collaborations and partnerships across the scientific community. Validation of our mission and goals has come from key institutions. This is essential to build the constituency necessary for success. An important development this year has been the potential role PNNL can play in the newly announced DOE/OBER Genomes to Life Program (GTL). We expect to become the DOE Signature Laboratory for bringing the Genome to Life; we have had three success indicators thus far: (1) several PNNL staff members have been invited to attend GTL technical workshops to establish prioritized research requirements in the areas of mathematics, computational science, data resource management, networking and computational infrastructure. (2) DOE/OBER has committed \$600K capital funds in FY01 for the Microbial Cell Dynamics Facility (MCDF) to purchase novel and integrated culturing systems that are viewed by DOE to be critical to the future GTL program. And (3) Reinhold Mann's new arrival to the Lab will directly contribute to our interactions with DOE/OBER.

BNI leadership has been successful in building a transformational set of capabilities and resources for PNNL to lay the foundation for a leadership role in the biological sciences for the next decade. While the development of these capabilities and the design and construction of an integrated systems biology user facility is a long term investment, we have achieved near term results in terms of business growth and capability development that ensure we are making progress toward attaining our vision.

FY2001 was a very successful year for the *Computation Science and Engineering Initiative*. The award of new research projects in support of DOE-SC's new Scientific Discovery Through Advanced Computing program, the completion and validation of a key software framework for treating aerosols and cloud processes, the addition of new staff, and significant expansion in network connectivity and computing capability represent major progress for this initiative and have substantially advanced our strategic agenda.

With respect to our *Nanoscience and Nanotechnology Initiative*, in FY2001, overall visibility of PNNL and Northwest regional nanoscience and technology activities were significantly increased by the formation of a Joint Institute for Nanoscience with the University of Washington. This institute also enhances PNNL capability by establishing links between the excellent materials and characterization strengths at PNNL with the strong nanobiology and photonic materials activities at the University of Washington. This strategic partnership leverages off the strengths of both institutions, positions the Laboratory to pursue additional business opportunities, and establishes a significant and sustainable graduate educational program at PNNL. It also represents a significant regional alliance that will help build stronger regional advocacy for the Laboratory. Other efforts to enhance the external visibility of the Lab's nanoscale research include participation in national workshops, publication of research in peer-reviewed journals, and the establishment of an external web site. The establishment of an email contact list and an internal web site enhanced internal communication and visibility.

## Biomolecular Networks Initiative

### Analysis

The FY2001 performance expectations for this initiative have been developed in partnership with DOE-RL and are documented in a Memorandum of Understanding (MOU). Our assessment of our FY2001 performance, as documented in the following text and in Initiative files, provides evidence that we have met or exceeded the performance requirements of the MOU warranting an **Outstanding** rating for this initiative.

### Key outcomes from this initiative included in the following highlights.

- ♦ Steven Wiley presented part of the initiative's vision and direction to DOE/OBER in January 2001 receiving OBER's enthusiastic response and support, which is pivotal to our full participation in the GTL. Ari Patrinos, OBER Associate Director, emphasized the importance of our continued commitment to hire senior scientists with backgrounds in systems biology.

- ♦ PNNL's membership in the Joint Genome Institute (JGI) was announced last fall. This valued membership provides a springboard for collaborations and program proposals and another direct link to the DOE/OBER Genomes to Life Program. Currently major JGI interest is in our proposals for proteomics, high throughput generation of high affinity antibodies via yeast-based display, and high throughput, cell free protein production. PNNL was given the lead for the Microbial Cell program, the first installation of the Genomes to Life initiative.
- ♦ An impressive external advisory panel was assembled this July to provide independent input and offer council on the Initiative's strategy, direction and approach. The panel included:
  - David Galas, Keck Graduate Institute of Applied Life Sciences
  - Ray Gesteland, University of Utah
  - Doug Lauffenberger, Massachusetts Institute of Technology
  - Jennifer Linderman, University of Michigan
  - David Low, University of California at Santa Barbara
  - Ken Nealson, JPL, Cal Tech
  - Jean Wang, University of California at San Diego
  - Sunney Xie, Harvard University
- ♦ BNI continues to sponsor national level workshops organized this year around key biomolecular networks and cell signaling.
  - (1) The 39<sup>th</sup> Hanford Life Sciences Symposium, titled "Cellular Communication: Information Processing at the Cell Surface" will be held October 2001 in Richland. The sessions planned include: (a) Passive communication with subtopics of cellular matrix, cell-cell contact, soluble factors, and chemotaxis and migration, and (b) Active communication with subtopics of autocrine signaling, regulated proteolysis, and growth factors and development.
  - (2) PNNL will co-host the 2<sup>nd</sup> SUN Microsystems/PNNL/San Diego Supercomputer Center Conference on Computational Biology, High Performance Computing and Bioinformatics, *Computational Challenges in the Post-Genomic Age 2*". Dave Dixon organized the conference originally to be held to be held Sept. 13-15, 2001 in Durham, North Carolina; now rescheduled for Spring 2002. The four topical areas are:
    - ♦ Bioinformatics and Databases
    - ♦ Algorithms for Discovery Life Science
    - ♦ Protein Structure, Function and Integration
    - ♦ From Protein to Disease
  - (3) BNI will sponsor the Virtual Biology Workshop, Part 2, "From Genome to Cell Function – Modeling the Cell as a Complex System". Though originally scheduled for September 12-13 in Durham, N.C. it is now being held December 2001 in Seattle, WA. Participants include NIEHS, PNNL and ORNL.
  - (4) The 38<sup>th</sup> Hanford Life Sciences Symposium was held in October 2000, with one of the best attendances in recent years. Held in conjunction with the annual PNW Association of Toxicologist, the Symposium explored "Susceptibility Issues in Contemporary Environmental Health" with sessions on: genetic susceptibility to environmental carcinogens; metabolizing enzymes as determinants of susceptibility; genetic components of ionizing radiation susceptibility; and growth factors as determinants of susceptibility.
- ♦ In May 2001, the initiative held an important workshop in Richland hosting ten National Cancer Institute managers and scientists from which the following principal outcomes emerged. It was concluded that a partnership between EMSL and NCI would be of considerable mutual benefit; NCI scientists would gain immediate access to new technologies being developed at PNNL, and PNNL scientists would gain access to important biological problems for validation, application, and further development of technologies. Initially, the program would involve access to PNNL technology on site. Upon maturity, technologies could be transferred to NCI and/or operated at PNNL for NCI and other users, depending upon the nature of the technology. A series of pilot projects are being developed in several research areas of interest. Depending on the outcome of these initial projects, much broader interactions will be considered.



**Recruiting Accomplishments.** A primary focus of the initiative leadership, the recruiting efforts, have been very successful this year culminating in four offers accepted by high level scientists. Specifically directed toward attracting and hiring senior systems biologists and young, technology-oriented biologists, PNNL's reputation is now attracting the right talent and expertise. We have identified and recruited individuals dedicated to multidisciplinary biology approaches and show a willingness to build collaborative relationships while leveraging PNNL's niche.

The recruiting team meets weekly and has achieved the following:

- ♦ Filling a senior position this year, Dr. Karin Rodland of OHSU will arrive October 2001. Karin's expertise and reputation in cell signaling associated with ovarian cancer is significant. Dr. Rodland's funded NIH projects will accompany her.
- ♦ Dr. Deborah Payne, an integrated software developer with expertise in scientific leadership will join the lab in November 2001.
- ♦ Dr. Tom Squire, a senior biochemist studying regulation of protein-protein interaction through redox reactions, has accepted our offer and will arrive December 2001. NIH projects will accompany Tom.
- ♦ Dr. Diana Bigelow has accepted a position at WSU-TC, to be a tenured position cost shared by PNNL. Dr. Bigelow will help build a new multi-disciplinary program in systems biology at WSU-TC. NIH grants will accompany Dr. Bigelow.

Four mid-level new hires include:

- ♦ Dr. Chii-Shiang Chen, expertise in cell biology using molecular probes to visualize cellular processes arrived in June 2001.
- ♦ Michael Feldhouse joined the lab in May 2001 supporting the single chain antibody research.
- ♦ Dr. Robert Siege, a systems biochemist with expertise in high throughput proteomics using antibodies will arrive mid-October 2001.

**Communications Highlights.** The BNI launched its two web sites this spring in record time. The internal site, <http://www.pnl.gov/bni/> and the external site, <http://www.biomolecular.org>, provide a clear and consistent message to our customers, partners, PNNL staff and stakeholders. Our communications team, will continue to monitor and update these sites as needed. Statistics for the website are tabulated monthly and show impressive use.

#### **Program Development Accomplishments.**

Since October 2000, high quality proposals have been submitted to DOE and NIH totaling over \$35M in potential multi-year funding meeting our highest expectations. Highlights include:

- ♦ OBER Low Dose Calls – nine full proposals totaling over \$5.2M
- ♦ NCI Call “Technologies for comprehensive, sensitive and quantitative protein analysis in human tumors” drew four proposals. Dick Smith received one of the highest ratings for the proposal “Technology for global and quantitative proteome analysis of human tumors”, a four-year value at \$2.5M.
- ♦ OBER Microbial Genome and OBER Microbial Cell Calls - seven proposals totaling over \$10M
- ♦ NIGMS Call “Quantitative Approaches to the Analysis of Complex Biological Systems” – proposal in collaboration with MIT, value \$1.5M for PNNL
- ♦ MISC/OBER, Computational Microbial Cell Call, three proposals submitted for over \$3M

#### **Increased Market Share with DOE and NIH.**

We have surpassed our FY2002 target to increase the total biological science business with DOE-OBER and NIH by \$8M; we are now showing an increase of over \$25M in new sales, with sales spanning multiple years. A few highlights include:

- ♦ NIGMS award for Steve Wiley's “Regulated Ligand Access in Control of Receptor Processes” four-year contract for \$1.525M
- ♦ OBER's capital outlay to purchase a 500 MHz wide-bore NMR System to Robert Wind,



\$750K. We are now showing a total OBER capital FY01 outlay of \$2.85M which includes the NMR System, a 9.4 TESLS Mass Spectrometer, and microbial novel culturing systems.

- ♦ OBER's Microbial Genome Program awards to Fred Brockman and Bill Cannon totaling \$1.625M

Working with Dr. Bill Brady, Medical Director of HEHF, Kelvin Soldat continued his efforts to establish programmatic funding in the area of Worker Monitoring and Protection. A meeting was held with Paul Kruger and Doug Shoop, DOE-RL. It was well received and seed money of \$100K for this year is being authorized. In addition, Gerald Boyd, EM-50, committed to \$50-\$100K of seed money saying DOE-EH would match that amount. Kelvin met with Rick Jones, Office Director for Worker Health and Safety (EH-5), he reviewed the program plan and has committed his support. Also, Dr. Bill Brady met with Frank Hawkins, Office Director of Health Studies (EH-6), and they are interested in supporting the program. Our intent is to get \$300K of seed money this year and close to \$1M next year. The program would be based at Hanford with the intent to expand it to the rest of the DOE complex in the following years.

**Partnership and Collaboration Accomplishments:** We continue to focus on a select few partners and collaborators with success in institutionalizing our relationships and have achieved our highest aspirations as a result. Through our numerous visits to universities and government agencies, we have identified a core constituency of scientists that are an ideal complement to our emerging program. Biologists working in the area of molecular cell biology and signal transduction are particularly interested in our scientific program because it addresses critical technological issues in these areas. Key to working with NIH is having the support of a specific group of scientists that can provide the problem set for grants and are willing to promote our research agenda. Identifying our core constituency is thus crucial to the success of our program.

Written agreements and joint projects with U of W and MIT are in place. We continue to strengthen our partnership with OHSU to establish joint projects.

- (1) An active working relationship has been established between U of W and PNNL by working through the Cell Systems Institute of U of W. A formal agreement between PNNL and UW/CSI was signed in July 2001. In advance of that formal agreement, we proceeded with the development of programs of joint interest through technical exchanges, which have thus far included several technical meetings at PNNL and UW/CSI. Efforts are underway to develop programs utilizing existing funding where applicable and preparing joint proposals for additional research programs.
- (2) We successfully competed for a five-year, joint grant with MIT funded for \$1.5M by the NIH, to support a collaborative project between Dr. Douglas Lauffenburger of MIT and Dr. Steven Wiley of PNNL. The proposal was in response to the NIH program in "Quantitative Approaches to the Analysis of Complex Biological Systems". The first phase of a joint project with Dr. Dane Wittrup of MIT was completed and will be followed this fall by a trip of PNNL scientists to MIT to learn antibody selection protocols. Robert Wind has had discussions with David Cory of MIT on the Gradient Coil Construction project. Dave Dixon is continuing discussions with B. Berger in the Mathematics and Computer Science Department.
- (3) A written agreement with OHSU will be finalized this fall. The initial products of our ongoing interactions include: multiple related interactions conducted among staff of PNNL, OHSU, and OGI; site visits by delegations of researchers and administrators; invited lectures; potential appointment of PNNL staff member (Steve Wiley) as an OHSU adjunct professor; planning for regular seminars and a steering committee. Research collaborations consist of:
  - ♦ A collaborative project in viral proteomics with Jay Nelson (OHSU), Thomas Conrads and Dick Smith (PNNL), and Thomas Shenk (Princeton).

- ◆ Deb Gracio, Bill Cannon, and Heidi Sofia (PNNL) are working with a team from OHSU to establish a project in multi-disciplinary bioinformatics. A NIH proposal has been submitted to form a West Coast Core Genomics Facility with a strong role proposed for PNNL.
  - ◆ Heidi Sofia is developing a new collaboration with Klaus Frueh, Director of Genomics, in the area of application of novel bioinformatics methods to a PHD zinc finger family.
  - ◆ Dick Smith (PNNL) is collaborating with Caroline Enns to submit a proposal which involves mapping the sites of interaction between Tf and TfR.
- (4) A visit to San Diego to meet with UCSD and Scripts staff resulted in several positive outcomes whereby both institutes have become willing constituents in supporting PNNL's efforts to develop leading edge instruments for biologists and encouraging the increased involvement of DOE. On the science side, an existing collaboration on the development of a combined Patch Clamp/Confocal Microscope was strengthened through additional technical consultations with Professor M. Montal and his staff. A new collaboration was established between K. Hahn of Scripts and several PNNL staff. Dr. Hahn has unique capabilities for the synthesis of optical probes for biological processes. Materials transfer agreements are now in place and materials are being supplied by Dr. Hahn to support new collaborations with PNNL's biomolecular interaction assay system with on-column fluorescence detection to be used to investigate binding of these proteins. A collaboration has been initiated between Gordon Gill of UCSD and Rick Zangar and Steven Wiley of PNNL. This collaboration is developing technical approaches to analyze the protein composition of signaling complexes from cells. Preliminary data is being obtained that will lead to applications for external funding.
- (5) The Virtual Respiratory Tract (VRT) collaborations are progressing very well. Otherwise known as the Virtual Lung LDRD, Rick Corley's group is developing a joint proposal with UW and CIIT Centers for Health Research to respond to NIH's Bioengineering Research Partnership Call, due January 2002. Entitled: "Development of a 3-Dimensional Biologically Based Computational Model of the Cardiopulmonary System. A Modeling Paradigm for the Diagnosis and Treatment of Respiratory Tract Disease".
- (6) Collaboration activities with other partners, though not currently highlighted in the Biomolecular Systems Institute (UW, OHSU, MIT, and UCSD) framework, are important in strengthening our programs in biological research. Our discussions with Washington State University regarding implementation of a Graduate program in Systems Biology included Steve Colson, Eric Leber, and Wendy Owen (PNNL) and Ed Reichle (WSU). Steve Wiley presented the concepts and implementation ideas to WSU President Rawlings, which resulted an enthusiastic response. A new tenured position has been created at WSU-TC to be cost shared by PNNL. Dr. Diana Bigelow will help build a new multi-disciplinary program in systems biology at WSU-TC this coming year.
- Publication Accomplishments.** Over twenty papers have been submitted for publication in peer-reviewed journals far surpassing our aspirations. Fifteen have been accepted for publication this fiscal year. Examples of published articles include:
- ◆ R.A. Wind, K.R. Minard, G.R. Holtom, P.D. Majors, E.J. Ackerman *et al.*: "An Integrated Confocal and Magnetic Resonance Microscope for Cellular Research," *Journal of Magnetic Resonance* 147, 371-377 (2000).
  - ◆ P. D. Majors, T. J. Weber, G. R. Holtom, K. R. Minard, and R. A. Wind, "Combined Optical and Magnetic Resonance Microscopy of Heterogeneous JB6 Tumor Spheroid Populations", *Proc. ISMRM* 9, 725, (2001).
  - ◆ Y. Shen, R. Zhao, M. E. Belov, T. P. Conrads, G. A. Anderson, K. Tang, L. Pasa-Tolic, T. D. Veenstra, M. S. Lipton, and R. D. Smith, "Packed Capillary Reversed-Phase Liquid Chromatography with High-Performance

Electrospray Ionization Fourier Transform Ion Cyclotron Resonance Mass Spectrometry for Proteomics”, *Anal. Chem.*, 73, 1766-1775 (2001).

- ♦ T. P. Conrads, K. Alving, T. D. Veenstra, M. E. Belov, G. A. Anderson, D. J. Anderson, M. S. Lipton, L. Pasa-Tolic, H. R. Udseth, W. B. Chrisler, B. D. Thrall, and R. D. Smith, “Quantitative Analysis of Bacterial and Mammalian Proteomes Using a Combination of Cysteine Affinity Tags and  $^{15}\text{N}$ -Metabolic Labeling”, *Anal. Chem.*, 73, 2132-2139 (2001).
- ♦ D. P. Chandler, F. J. Brockman, D. A. Holman, J. W. Grate and C. J. Bruckner-Lea, “Renewable microcolumns for solid-phase nucleic acid separations and analysis from environmental samples”, *Trends Anal. Chem.*, 19(5), (2000) 314-321.

## Computational Sciences and Engineering Initiative

### Analysis

The FY2001 performance expectations for this initiative have been developed in partnership with DOE-RL and are documented in a Memorandum of Understanding (MOU). Our assessment of our FY2001 performance, as documented in the following text and in Initiative files, provides evidence that we have met or exceeded the performance requirements of the MOU warranting an **Outstanding** rating for this initiative.

FY2001 was a very successful year for computational science and engineering, with major progress in business development, software, and organizational visibility. Accomplishments, which substantially advanced our strategic agenda, include:

- ♦ Award of nine new research projects from proposals to DOE-SC’s new Scientific Discovery through Advanced Computing program, with expected funding of over \$10M over 3-5 years (project lengths vary).
- ♦ Completion and validation of the PEGASUS framework for treating aerosols and cloud processes; four new projects awarded from the DOE-OBER Atmospheric Chemistry Program, with expected funding of \$3.4M over two to four years (project lengths vary).
- ♦ Development of techniques for modeling and optimizing hydroforming; award of 2 new proposals in joining of dissimilar materials from DOE OTT, and 2 new CRADAs in composite materials, with total expected funding of \$3.1M over 2-4 years (project lengths vary).
- ♦ Jupiter Computer operational since March 1, 2001; exceeded usage goals at 48% with 31 projects comprising 89 users, major upgrade performed without impact to users
- ♦ External Network Connectivity increased to 155Mbps (OC-3)
- ♦ Access Grid Node installed in ISB1 (\$71K)
- ♦ Funds received for new computer science research computer (\$321K)
- ♦ Substantial new opportunity in subsurface modeling with EM partnership with INEEL
- ♦ Creation of the Computational Sciences and Mathematics directorate in PNNL’s Fundamental Science Division, with 54 full time staff.
- ♦ three new staff hired

In addition to very significant progress on many fronts as shown above, the Computational Science Initiative met nearly all of its formal Critical Outcome goals for a rating of **Outstanding**.

## Nanoscience and Nanotechnology Initiative

### Analysis

The FY2001 performance expectations for this initiative have been developed in partnership with DOE-RL and are documented in a Memorandum of Understanding (MOU). Our assessment of our FY2001 performance, as documented in the following text and in Initiative files, provides evidence that we have met or exceeded the performance requirements of the MOU warranting an **Outstanding** rating for this initiative.

This initiative expands current Laboratory capability by using LDRD funding to establish collaborative research programs that integrate the range of scientific and engineering disciplines necessary to advance and exploit science and technology at this

length scale. The new programs build on established laboratory strengths in the areas of self-assembly, interface chemistry and engineering (especially for oxides), characterization (one focus of the EMSL capabilities), and modeling. Enhanced research capability is being focused on synthesis of materials and structures at the nanoscale, both purely inorganic systems (a strength of the Lab) as well as so-called soft materials interfaces, where inorganic and organic media meet and combine with unique properties.

Seven research efforts were initiated in FY2001. The primary criteria for the selection of these projects was high quality science, with the objective of developing new fundamental capabilities that will have scientific impact now and technological impact in the future:

- ♦ One project is developing a robust new semiconductor material that demonstrates room-temperature ferromagnetism. This is one approach to breakthroughs in “spintronics” that could increase computer memory by many orders of magnitude while drastically reducing energy consumption.
- ♦ Another project has developed oxide quantum dots, also called “artificial atoms”, that have significantly enhanced thermal and chemical stability. Quantum dots with highly tailored photocatalytic properties and band structures could lead to efficient energy and chemical conversion processes and serve as the basis for new sensors and electronic materials.
- ♦ Monolithic nanoporous thin films with incredibly high surface areas were generated using molecular beam epitaxy.
- ♦ Functionalized nanoparticles were developed that could be used for highly sensitive analysis of very small samples.
- ♦ Another project developed a route to structured nanorod materials with very high aspect ratios.
- ♦ Our effort in nanobiology focused on the immobilization of enzymes within nanoporous media, which was found to significantly prolong their activity.
- ♦ Finally, the initiative included one project each in enhanced characterization tools (specifically, improvements to atomic force microscopy) and

in modeling of structure, flow, and transport in nanoscale systems.

Research on these projects has resulted in six publications with eight additional submissions in the initiative’s first year. The work on a room temperature ferromagnetic semiconductor by Scott Chambers has received both technical and media attention. Four high-quality proposals were submitted to the BES Nanoscience, Engineering and Technology call, and one was selected for funding. The research work was presented at several technical conferences (three of which were invited talks), and the first of two expected patent applications has been filed.

In FY2002, we will focus our resources on five of our most promising and cutting-edge efforts, including the first four projects mentioned above. We will also begin to drive the programs in directions that show promise for application in targeted areas. One new project will be initiated in FY2002 to develop photovoltaic materials with higher energy conversion efficiencies. In addition, one new task was added to an existing project to explore the application of oxide quantum dots to radiation detection. Both of these new efforts have direct links to the applied mission areas of the Laboratory.

In conjunction with the Lab’s research divisions, seven major application areas have been identified where the initiative has a high potential to impact the Lab’s business:

- ♦ Sensors
- ♦ Catalysts
- ♦ Separations media
- ♦ Gas storage media (e.g. hydrogen storage in fuel systems)
- ♦ Electronics
- ♦ Communications
- ♦ Energy conversion

Each of the projects in the LDRD portfolio shows promise for fueling innovation in at least one of these areas. By supporting cutting-edge research that will bear fruit in advancing knowledge in these application areas, the initiative directly supports each of the primary mission areas of the Department



of Energy: advancement of basic science, enhancement of national security, provision for a secure energy future, and cleaning up the production complex.

## Academic Partnerships and Science Education

### 1.6 Create and Maintain Strategic Academic Partnerships That Strengthen Scientific Capabilities and Demonstrate Leadership in Educating Future Scientists

#### Results

The science education programs continued to provide **Outstanding** service as evidenced by a September 10, 2001 memo from DOE/SC which stated in part that “During this fiscal year, PNNL’s Science Education group has continued to demonstrate their outstanding and unparalleled management of the three undergraduate programs funded by the Office of Science – Energy Research Undergraduate Laboratory Fellowship (ERULF), Community College Institute (CCI), and Pre-Service Teacher (PST) Programs.”

The memo further complimented the newly initiated FaST program noting that “This summer was the first year of our Faculty and Student Team (FaST) pilot program and PNNL was the only laboratory we selected to participate in it. Both the students and faculty members were very enthusiastic about their opportunity to work at a National laboratory. They gave the program glowing marks and greatly appreciated the experience and the assistance from the science education staff.”

Finally, PNNL’s EduLink efforts elicited “We consider the EduLink an integral part of our programs. The service provided by the staff at PNNL and its entire application and tracking system are progressing better than we have expected. The program knowledge of the staff has been of immense help in designing the new on-line application. In addition, the PNNL staff have strived to find ways to be creative, and cost-effective mechanisms to keep the tasks on time and under budget. We look forward to a productive partnership in this programmatic effort.”

University partnerships had a significant impact on PNNL research in FY2001. In addition to achieving an outstanding rating according to the Critical Outcome performance indicator as detailed below, the laboratory made great progress in building Joint Research Institutes this year.

The Joint Institute for Nanoscience was established between the University of Washington (UW) and Battelle Memorial Institute on April 17, 2001. A steering committee has been formed to guide related programs and plans.

The Joint Global Change Research Institute was established between the University of Maryland and the Battelle Memorial Institute on March 12, 2001. The Institute has secured space at the University’s Baltimore Avenue location and commenced business operations there on September 17, 2001.

The Cell Systems Institute was established July 13, 2001 between the University of Washington and Battelle Memorial Institute. This partnership will define and pursue a joint program in cell signaling by developing tools, computational resources, and related technologies to measure and predict dynamic cell properties and to strengthen existing collaborative research and development projects in Cell Signaling at the University (including CSI) and PNNL.

Based on our performance against the sub-indicators that support this performance indicator, we believe our performance rating is **Outstanding**.

#### Analysis

**Impacts of Laboratory-sponsored programs for K-12 teachers of science, mathematics, and technology education in partner school districts.** Four Laboratory-sponsored programs for teachers of science, mathematics, and technology were conducted in FY2001. Seventy-four teachers participated in the programs. Fifty-nine (59) teachers completed evaluation surveys for a return rate of 80%. Of the 59 teachers completing surveys, fifty-four (54) of the evaluations (91.5%) received had a sum of 10 or higher.



Individually, the four teacher programs we conducted received the following performance ratings:

- ♦ Partnership for Arid Lands Stewardship (PALS) Program – Outstanding. One hundred percent (100%) of the evaluations received had a sum or 10 or higher
- ♦ Scientist-Student-Teacher (SST) High School Research Project – Outstanding. Eighty-six (86%) of the evaluations received had a sum of 10 or higher
- ♦ Teacher Research Participation (TRP) Program – Outstanding. Eighty-six percent (86%) of the evaluations received had a sum or 10 or higher, and
- ♦ Pre-Service Teacher (PST) Project – Excellent. Ninety percent (90%) of the evaluations received had a sum of nine or higher. Seventy percent (70%) had a sum of 10 or higher.

**Impacts of Laboratory-sponsored programs for secondary and post-secondary students in the areas of science, mathematics, engineering and technology.** Five Laboratory-sponsored programs for secondary and post-secondary students in the areas of science, mathematics, engineering and technology were conducted in FY2001. A total of 140 participants attended our student programs. One hundred thirty-five (135) students completed evaluation surveys (a return rate of 96%). Of the 135 students completing surveys, 110 of the evaluations received had a sum of 10 or higher (81.4%).

The five student programs during FY2001 we conducted received the following performance ratings:

- ♦ Community College Institute (CCI) – Outstanding. Ninety-one percent (91%) of the evaluations received had a sum of 10 or higher
- ♦ Energy Research Undergraduate Laboratory Fellowship (ERULF) Program – Outstanding. Seventy-eight percent (78%) of the evaluations received had a sum of 10 or higher
- ♦ Scientist-Student-Teacher (SST) High School Research Project – Outstanding. Eighty-five percent (85%) of the evaluations received had a sum of 10 or higher

- ♦ Student Research Apprenticeship Program (SRAP) – Outstanding. Eighty-six percent (86%) of the evaluations received had a sum of 10 or higher, and
- ♦ Student Research Internship (SRI) Program – Excellent. Eighty-six percent (86%) of evaluations received had a sum of nine or higher. Seventy-three percent had a sum of 10 or higher.

In addition, teacher and student surveys yielded the following information.

- ♦ According to the teacher evaluations, PNNL's teacher programs had the greatest impact on teacher content knowledge. More than 86% (86.4%) gave this a rating of four (top of the scale). Almost 80% of teachers gave our teacher programs a top rating of four on "transfer to the classroom." Seventy-eight percent (78%) of our teachers gave our teacher programs a top rating of four on skills development.
- ♦ According to the student evaluations, PNNL's student programs had the greatest impact on student skills followed closely by impacts on student content knowledge. Seventy-three percent (73%) of students gave skills the top rating of four. Seventy-two percent (72%) of students gave content knowledge the top rating or four. A majority of students (61.4%) gave our student programs a top rating of four on "career impacts."

**Impact of university partnerships on Laboratory research.** A detailed and extensive (approximately 300 pages) report titled *An Overview of PNNL's Institutional Relationships... The Laboratory-University Agreements*, provides a detailed description of the mechanics of establishing a Joint Research Institute (JRI). This report was used as a reference in preparing elements of the agreements with Washington State University (WSU), the University of Idaho (UI), and the Idaho National Engineering and Environmental Laboratory (INEEL) as well as with a number of Oregon institutions. All three of the JRIs established this year achieved meaningful progress in their respective education activities as noted below.

**The Joint Institute for Nanoscience** was established by Appendix A to the Joint Institutes Affiliation Agreement between the University of Washington (UW) and Battelle Memorial Institute on April 17, 2001. A steering committee has been formed to guide related programs and plans. Drs. Charlie Campbell (UW) and Don Baer (PNNL) have been named co-directors of the JRI and are currently finalizing a call for applications for student and post-doctoral appointments that are elements of the Institute. The significant events associated with this JRI are listed below:

- ◆ PNNL's Dr. Paul Burrows accepted the role as Manager of the Nanoscience & Nanotechnology Initiative on August 15, 2001.
- ◆ An initial workshop, held on the UW campus on August 16 and 17, 2001, featured a series of presentations and posters on pertinent topics. Approximately 130 attendees, including 18 from PNNL and about 100 faculty and students from the UW. (Other participants were from California Polytechnic State University, the University of Alaska, the University of Nevada, the University of Portland, and Washington State University).
- ◆ More than a dozen UW graduate students in nano-science and technology visited PNNL on August 27 and 28, 2001, to learn-first hand of the operations and opportunities at PNNL and the EMSL.
- ◆ Four UW students have been issued graduate appointments to pursue activities under this Institute agreement.
- ◆ Interactions are proceeding with Professor Thomas Stoebe, UW's Materials Science & Engineering Department, regarding the proposed enhancement of K-12 teacher professional development and student learning in nano-related fields.
- ◆ Related joint research is defined under several LDRD-funded elements of the nanoscience Institute.
- ◆ PASS (PNNL Affiliate Staff Scientist) appointments have been extended to faculty in allied fields (specifically, the UW's Tom Stoebe).

**The Joint Global Change Research Institute** was established through a Memorandum of Understanding between the University of Maryland and the Battelle Memorial Institute on March 12, 2001. The Institute has secured space at the University's 8400 Baltimore Avenue location and commenced business operations there on September 17, 2001. One summer student was associated with the work of this Institute, and two graduate students have been assigned to support select areas of the JGCRI. An inaugural conference has been scheduled for October 12, 2001.

The **Biomolecular Systems Institute** will pull together an extended alliance of entities possessing critical and complementary capabilities in systems biology. Initial academic partners include the Massachusetts Institute of Technology, Oregon Health & Science University, University of California at San Diego, University of Washington, and Washington State University.

The **Cell Systems Institute** (CSI) was established July 13, 2001 with the signing of Appendix B to the Joint Institutes Affiliation Agreement between the University of Washington and Battelle Memorial Institute. This partnership will define and pursue a joint program in cell signaling by developing tools, computational resources, and related technologies to measure and predict dynamic cell properties and to strengthen existing collaborative research and development projects in Cell Signaling at the University (including CSI) and PNNL. CSI is an operating unit within the UW School of Medicine.

The Steering Committee has been appointed and is examining potential calls for proposals and determining candidates for graduate, post-doctoral, and faculty appointments within CSI.

Washington State University, Tri-Cities and PNNL have outlined a Partnership for Education and Research in Systems Biology and Molecular Biology. A principal priority of this partnership will be the development of WSU-TC as a destination campus for graduate students in the biosciences and

biotechnologies. Current efforts are focused on recruiting a prospective joint faculty member in biochemistry and molecular biology. Shifting to WSU-TC the Battelle/PNNL Distinguished Professorship in Bioprocessing and Microbiology has been proposed.

OHSU and PNNL have begun several collaborative projects and will begin work this Fall in answering proposal calls. It is likely that these activities will be among the first items considered by the Collaborator Working Group formed by the Memorandum of Understanding (signed September 5, 2001) among Institutions of Higher Education in Oregon and the Battelle Memorial Institute.

Also associated with the Biomolecular Systems Institute are site visits and seminars (including Internet-based streaming videos live from EMSL), adjunct faculty appointments, and staff/student visits and exchanges.

Strong research interactions with Oregon Health & Science University faculty have resulted in PNNL's permanent hire of a researcher (Karin Rodland) in the biosciences.

PASS appointments have been extended to faculty in allied fields, specifically, Gary Drobney of UW and Keith Dunker and Luying Xun of WSU.

### **Northwest Collaborative Institute for Bioproducts Research**

To provide a basis for this consortium, which will draw upon the combined expertise of regional institutions to create a nationally renowned capability in the production of valuable products from agricultural materials, a draft Memorandum of Understanding has been prepared and is under active review by Battelle Memorial Institute and Washington State University, the University of Idaho, and Bechtel BWXT Idaho (manager of the Idaho National Engineering and Environmental Laboratory).

Overview presentations to the President of the University of Idaho, the Dean and external advisors of WSU-TC, and others have been very well received. Alternative funding scenarios are currently being examined and an artist's rendering of the associated multi-user research and test facility has been obtained.

### **Scientific & Technological Excellence Performance Rating**

The overall performance rating for the Scientific & Technological Critical Outcome is determined by comparing the total value for the outcome, as determined in Tables 1.4 and 1.5, to the rating table in Table 1.6.

**Table 1.4.** Objectives 1.1 through 1.4 Scientific and Technological Excellence Evaluation Score Calculation for Program Offices

HQ Program Office	Adjectival Rating	Value Points	Weight	Weighted Score	Overall Weighted Score
Office of Science	Outstanding	5	30%	1.5	
Assistant Secretary for Environmental Management	Outstanding	5	25%	1.25	
Office of Nonproliferation and National Security	Outstanding	5	15%	0.75	
Office of Intelligence	Outstanding	5	5 %	0.25	
Office of Counterintelligence	Outstanding	5	5 %	0.25	
Assistant Secretary for Energy Efficiency and Renewable Energy	Outstanding	5	10%	0.5	
Assistant Secretary for Fossil Energy	Outstanding	5	10%	0.5	
				Overall Program Office Total	5.0

**Table 1.5.** Science and Technological Excellence Critical Outcome Overall Score Calculation

Element	Adjectival Rating	Value Points	Indicator Weight	Total Points	Objective Weight	Total Points
<b>Objectives 1.1 through 1.4: Program Office Total Scores (from Table 1.4)</b>	Outstanding			5.0	85%	4.25
1.5 Create leading-edge scientific capabilities to support evolving DOE Mission needs						
1.5.1 Progress against Biomolecular Networks Initiative expected outcomes	Outstanding	5	40%	2.0		
1.5.2 Progress against Computational Sciences Initiative expected outcomes	Outstanding	5	35%	1.75		
1.5.3 Progress against the Nanoscience and Technology expected outcomes	Outstanding	5	25%	1.25		
Obj 1.5 Total				5.0	10%	0.5
1.6 Create and maintain strategic academic partnerships that strengthen scientific capabilities and demonstrate leadership in educating future scientists						
1.6.1 Impacts of the Laboratory's K-20 science education programs	Outstanding	5	65%	3.25		
1.6.2 The impact of university partnerships on Laboratory research	Outstanding	5	35%	1.75		
Obj 1.6 Total				5.0	5 %	0.25
				Critical Outcome Total		5.0

**Table 1.6.** Scientific and Technological Excellence Critical Outcome Final Rating

Total Score	5.0 - 4.5	4.4 - 3.5	3.4 - 2.5	2.4 - 1.5	<1.5
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

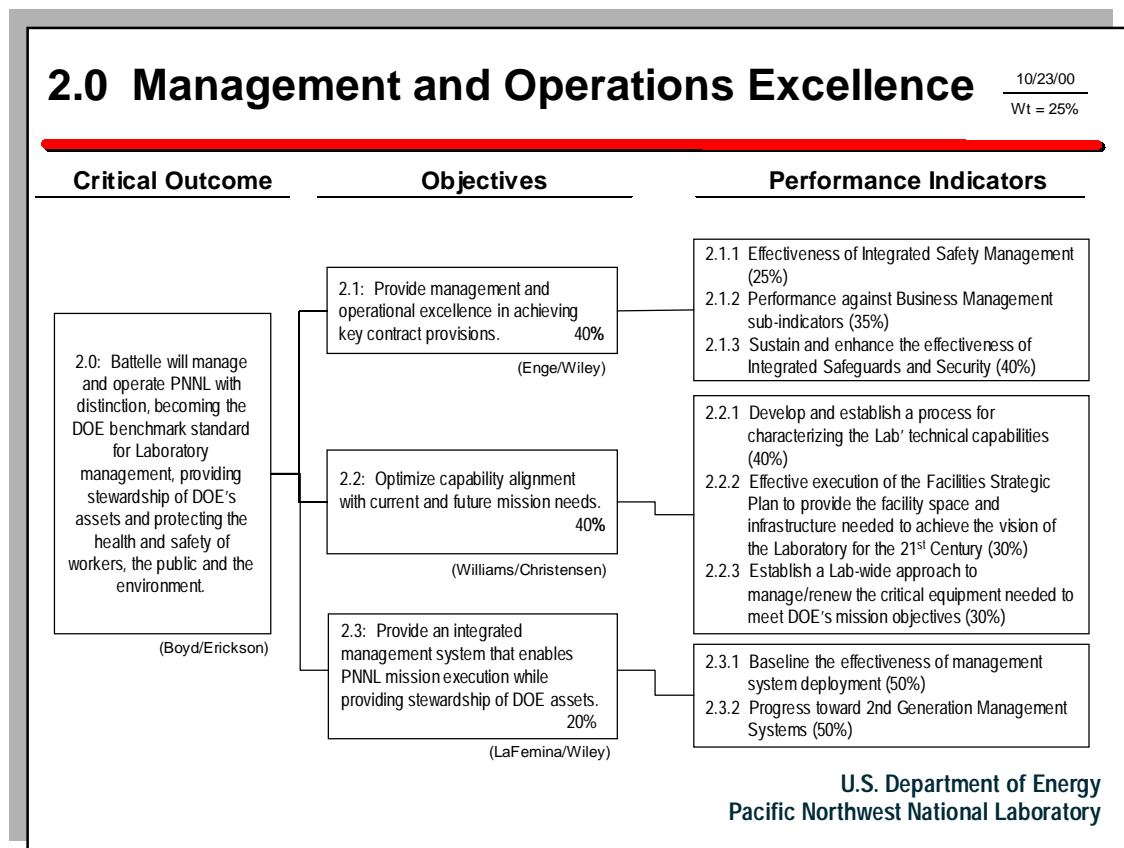
## 2.0 Management and Operational Excellence

The Department of Energy's Strategic Plan communicates a strong and unambiguous commitment to operational excellence and to ensuring the protection of our work force, the public, and the environment.

The Laboratory recognizes that strong scientific and technical performance can only be accomplished in conjunction with strong ES&H, Safeguards and Security, or operational performance. In fact, we believe that strong ES&H and operational

performance is an enabler of the execution of the Laboratory's mission related work.

For these reasons, and in partnership with the DOE, the Laboratory has established the Management and Operational Excellence Critical Outcome, and its supporting objectives to guide our improvement efforts, and performance indicators to monitor our progress toward our goals. The Management Operations Excellence is presented below.





## Summary

Pacific Northwest National Laboratory continues to conduct work and operate facilities with distinction and in a manner that is supportive of the Laboratory's science and technology mission. We have made significant investments over the past eight years to integrate sound safety and environmental management practices into daily operations. These investments are now paying off in lower accident rates for staff.

In acknowledgement of our commitment to protecting the health and safety of our staff, PNNL received the DOE Voluntary Protection Program (VPP) Superior Star Award during FY2001. This award, established by DOE to recognize superior performance in health and safety, acknowledges sites that demonstrate strong performance and strong involvement in VPP mentoring and outreach.

Our laboratory is committed to providing high quality science and technology at a competitive cost. By focusing on continued cost improvement and establishing business indicators in our performance agreement with the DOE, we are continuing to improve our cost performance.

In the arena of Safeguards and Security, we have continued to institutionalize the Integrated Safeguards and Security management system. These efforts have resulted in increased numbers of staff with current S&S training, receiving highest possible marks in three external S&S system evaluations, and, perhaps most notably, a reduction in reportable security incidents from eight in FY1999 to one in FY2001.

We have made significant progress in enhancing the internal processes necessary to understand current and future mission needs. These efforts have resulted in an increased ability to hire or develop the needed staff, facilities and equipment capabilities necessary to support those missions.

Execution of the Facilities Strategic Plan this year resulted in continued progress toward the infrastructure needs to achieve the Laboratory's vision

for the 21<sup>st</sup> Century. We activated the 20,000 sq. ft. Local Area Island (LAI) in EESB during the second quarter and we completed construction of the User Housing Facility on schedule. In addition, we have worked to revitalize existing facilities while working to make the 21<sup>st</sup> Century Campus of the Future a reality.

In support of our continuing efforts to streamline and improve the operational aspects of how the Laboratory delivers products and services to its customers, we assessed the maturity of each of our current management systems. Overall, our management systems are "Basically Effective." We received high marks in the design of the systems but have some holes in implementation. We will address these issues in FY2002.

We also focused significant efforts at developing the architecture for our Second Generation Management Systems. In support of this effort, we developed workflows of the Customer Service Model, defined and prioritized a "product" list of systems, processes, and tools that would be used to continue the development of the Second Generation Management Systems, and formally documented the architecture of the Second Generation Management Systems.

Based on our performance against the objectives that support this Critical Outcome we believe our performance rating is **Outstanding**.

### 2.1 Provide Management and Operational Excellence in Achieving Key Contract Provisions

#### Results

##### Effectiveness of Integrated Safety Management

In FY2001, the Laboratory continued to focus on ensuring operational excellence in ES&H through the effective implementation of the Laboratory's Integrated Safety Management (ISM) program. Performance measures supporting this objective identified the activities and requirements important to the success of the Laboratory's operations. In addition to the performance indicators established in the FY2001 Performance Evaluation and Fee

Agreement (PE&FA), DOE-RL AMT, and PNNL points of contact jointly agreed to sub-tiered goals and measures that were established through management system business plans and agreements.

We have met or exceeded all seven performance measures established in the PE&FA. Table 2.1 provides the detailed results of this measure compared to our targets for FY2001. Performance against this indicator demonstrates the effectiveness of PNNL's Integrated Safety Management program.

PNNL achieved DOE Voluntary Protection Program (VPP) Gold Star status in June this year providing external validation of the efficacy of our ISM program. PNNL also received the VPP Superior Star award. VPP is a recognition process adopted by DOE from OSHA. This process is aimed at recognizing worksites with successful comprehensive safety and health programs. The VPP Gold Star designation and Superior Star Award are intended as recognition for outstanding performers. PNNL is the first DOE Office of Science Laboratory to achieve VPP Gold Star status.

We continued to extend the envelope of the Integrated Operations System (IOPS) to additional facilities this year. This tool enhances research operations by integrating hazard identification and communication, identification and tracking of training requirements, hazard mitigation through self-assessment, detailed work practices, and user access authorization and control.

We developed and deployed numerous waste reduction improvements this year. We expect to realize reductions in costs and long-term liabilities for the Laboratory through these efforts. The improvements include the new Waste Forecasting Tool, Waste Planning Tool, a waste neutralization program, increases in the volume of waste treated in the Hazardous Waste Treatment Unit (HWTU), and bulking of wastes at the HWTU and 305-B facilities

PNNL implemented an Automated Radiological Access Control System (ARACS) that provides a better tool to verify requirements and qualifications needed to access radiological areas. The new system provides real time validation of a worker's qualifications prior to entry, along with several other improvements.

A gap analysis of the Laboratory's facility safety program was conducted. The basis for the requirements was 10CFR 830, Nuclear Safety Management, Subpart B. An action plan has been drafted, identifying necessary actions to be taken to demonstrate PNNL compliance with the safety basis requirements for the Radiochemistry Processing Laboratory.

An electrical safety assessment was performed at the Laboratory during FY2001. The assessment evaluated the electrical safety program design, implementation and compliance with regulatory requirements. The assessment concluded that PNNL's electrical safety program is robust, and that it is a model program, one that others within the industry could use as a benchmark.

Our laboratory is committed to providing high quality science and technology at a competitive cost. By focusing on continued cost improvement and establishing business indicators in our performance agreement with the DOE, we continue to improve our cost performance.

Our commitment to institutionalizing the Integrated Safeguards and Security management system is validated by the fact that more than 90% of our staff have current Safeguards and Security (SAS) training. We underwent three external evaluations of our Safeguards and Security program this year and received the highest grade possible from each evaluation. In addition, we have reduced reportable security incidents from eight in FY1999 to one in FY2001.

Based upon our performance against the sub-indicators that support this Performance Indicator, our rating for FY2001 is **Outstanding**.

## Analysis

### Effectiveness of Integrated Safety Management

This indicator is a composite of Performance Measures designed to provide an overall picture of the effectiveness of the Integrated Safety Management program at the Laboratory. The basis for the set of measures is, in part, the ISM effectiveness indicators developed by the DOE Safety Management Implementation Team (SMIT). PNNL continues to meet these performance measures and achieve outstanding progress toward deployment of management systems that provide value-added tools and promote a graded risk-based approach to research.

ES&H personnel routinely monitor the performance of these and other indicators. The composite of these measures provides an overall indication of the health of the Laboratory's Environment, Safety and Health program. Our FY2001 results indicate that the Laboratory is continuing to sustain excellence in the protection of workers, the public, and the environment.

For FY2001, all seven of the performance measures established in the PE&FA were met or exceeded. Table 2.1 below provides the results of the measures compared to the target values agreed upon for FY2001.

Figures 2.1 and 2.2 provide a statistical view of the Total Recordable Case Incident Rate and the Lost Workday Case Incidence Rate from January 1993 through the end of FY2001. As the control charts indicate, overall Laboratory performance against both measures has significantly improved over time. We are currently observing only normal process variation since the last mean was established.

In addition to our performance against the metrics established for ES&H, the following highlights from selected ES&H management systems performance data and self-evaluations indicate that PNNL staff and management are continuously improving the programs and systems necessary to safeguard the health and safety of our staff, the public, and the environment.

**Table 2.1.** PNNL ES&H Performance Targets and FY2001 Performance

Performance Measure	Specified (Target) Value	FY2001 Performance
Total Recordable Case Rate	$\leq 2.2$ Cases/200,000 work hrs	2.1
Lost Workday Case Incident Rate	$\leq 1.1$ Cases/200,000 work hrs	0.9
Reportable Occurrences of Releases to Environment	$\leq 2$ Events	0
Percent of Employees with Required Training	$\geq 95\%$	99.3%
Unplanned Dose	0 Events	0
Spread of Radioactive Contamination	$\leq 3$ Events	0
Loss of Control of Radioactive Material	$\leq 1$ Loss	0

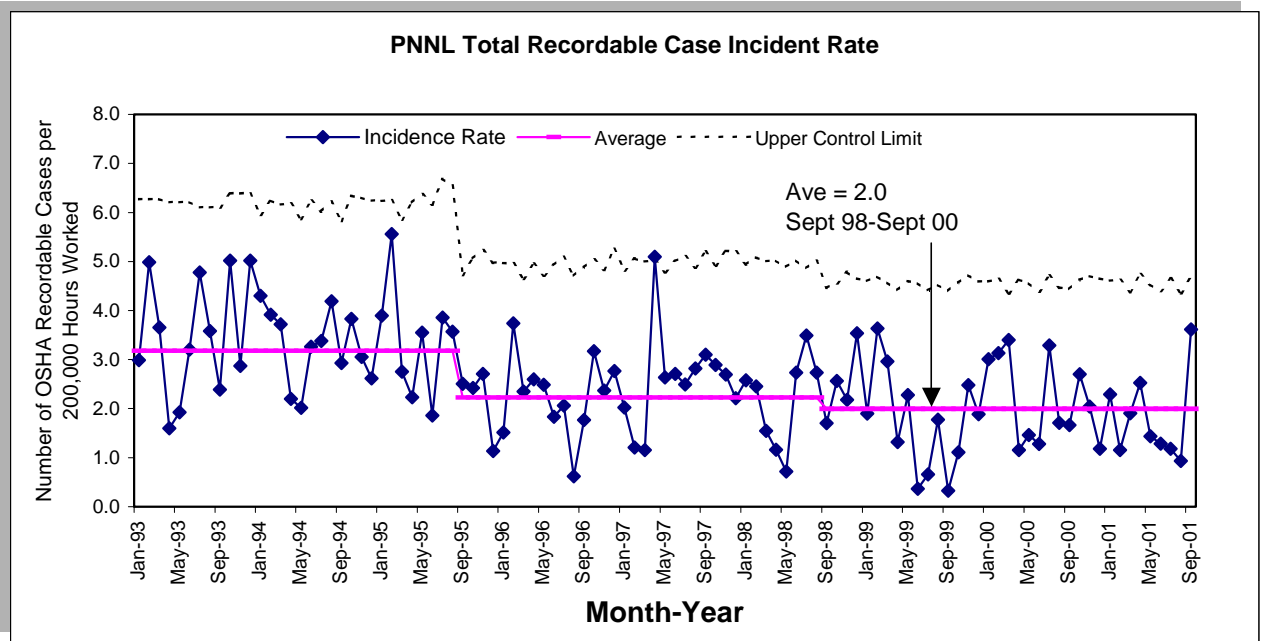


Figure 2.1. PNNL Total Recordable Case Incident Rate

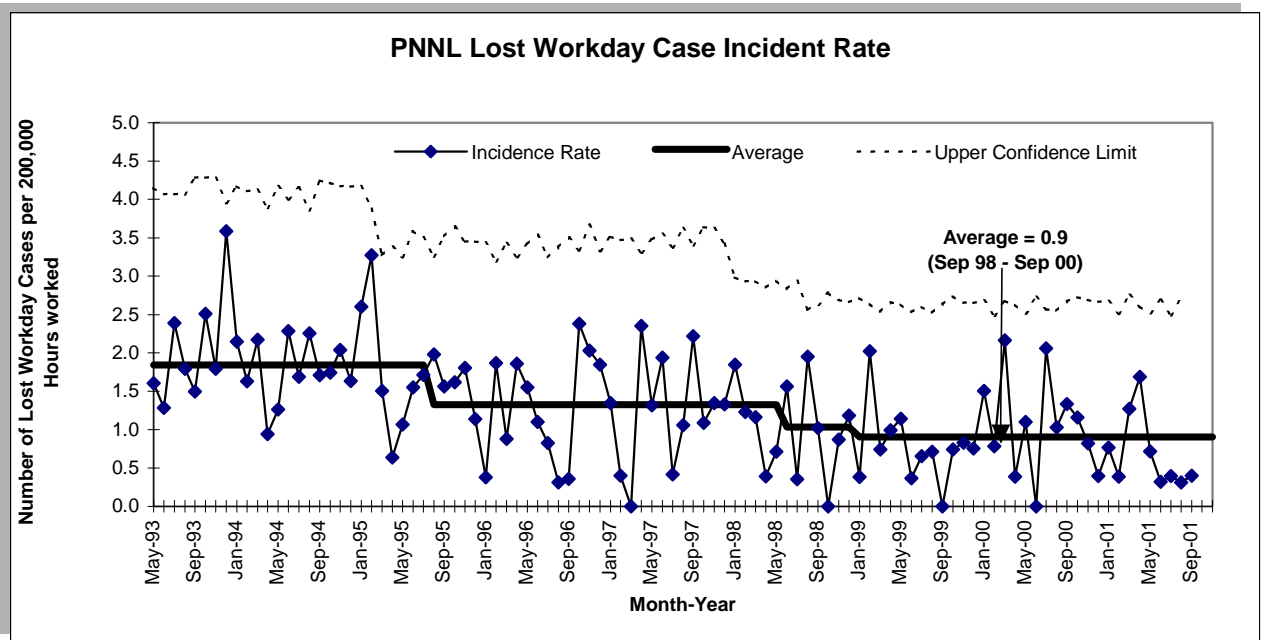


Figure 2.2. PNNL Lost Workday Case Incident Rate

## Worker Safety & Health

- ◆ A Lab review was conducted to identify where “biological select” agents are located and to ensure Centers for Disease Control and Prevention (CDC) requirements are met. The list of applicable requirements and the scope of self-assessment of applicable requirements were determined. A team composed of corporate and PNNL staff completed the self-assessment May 14-16, 2001. The assessment report has been released and actions have been developed and are being tracked.
- ◆ A review was conducted for incorporation of the Washington (State) Industrial Safety and Health Act (WISHA) ergonomics rule. A gap analysis was developed and actions are being tracked in Assessment Tracking System.
- ◆ A review was conducted for incorporation of the new OSHA Record Keeping Rule. Implementation is scheduled to be complete by January 1, 2002.
- ◆ A third-party assessment of the PNNL Electrical Safety Program was performed to assess support of safety staff in the field by providing verification of an appropriately designed and regulatory compliant program. The assessment identified areas to be investigated within R&D to potentially improve collective electrical safety. This project verified PNNL compliance with national standards and processes as they relate to electrical safety. It was recognized in this assessment that PNNL has an electrical safety program that others in the industry should benchmark. Recommendations were made to investigate computerized training issues and personal protective equipment issues. The Worker Safety and Health Management System will evaluate these issues.
- ◆ Restricted Workdays more than tripled this year, even though the Lost Workday Case Rate remained low. A small number of cases with repeat injuries account for nearly two-thirds of these restricted workdays. We are partnering with Facilities & Operations to aggressively pursue improvement in this area during FY2002.

## Radiological Control

- ◆ Radiological control self-assessments continue to examine and emphasize bench-top deployment of radiological control requirements, with a critical review of line management involvement and field performance. Four scheduled Radiological Control assessments were completed this fiscal year: External Dosimetry, Contamination Control, Radiological Training, and Fixed and Portable Radiological Instrumentation. In addition, self-assessments of the PNNL Radiological Control Counting Laboratory and of Sealed Sources and Radiological Material Control were performed.
- ◆ All of these assessments during FY2001, increased focus on trending has improved the self-assessment process. Radiological Problem Reports (RPR) are being tracked quarterly and potential repetitive and programmatic issues are analyzed for adverse trends. Trends were noted in the implementation of hold points, performance of job specific air sampling, and work planning. In each case, specific evaluations were performed and actions developed to address the causes. Although there was a decrease in the number of procedure-related RPRs during the last quarter of CY2000, the number increased during the first quarter of CY2001. Radiological control has begun tracking and control charting procedure-related RPRs to better evaluate the statistical significance of increases in procedural infractions. Facility Contaminations continue to be trended through FY2001 but no statistically significant trends have been noted.
- ◆ PNNL implemented an Automated Radiological Access Control System (ARACS) that provides a more user friendly, effective and efficient electronic tool to verify requirements and qualifications needed to access radiological areas. The new system provides real time validations of the worker's qualifications prior to entry, expanded capabilities for interpreting dosimetry data to demonstrate compliance with 10 CFR 835, and expanded data collection and retrieval for improved tracking and trending.



In parallel with the access control system, PNNL implemented an electronic tool for Radiological Work Procedure (RWP) preparation that reduces handoffs and will ultimately decrease the turn-around time for issuing RWPs. The new electronic system has an IOPS interface.

- ◆ DOE approved PNNL's request for liquid volumetric release limits in February 2001. Samples released under the new radiological criteria must still meet all current effluent and waste regulations when disposed of or released from the site. The effluent/waste limits are not consistent with the authorized limits for radiological release and in some cases do not allow disposal. Environmental Management Services is currently working with DOE to establish a single set of release criteria. Both DOE and stakeholder approval of revised effluent and waste release levels will be needed to implement this change.

#### Facility Safety

- ◆ The revised Operational Readiness Review program has been documented to enhance the deployment of the program and to meet the requirements of DOE O 425.1B, Start-up and Restart of Nuclear Facilities. Full implementation will be completed during FY2002.
- ◆ The 10 CFR 830, Nuclear Safety Management, Subpart B, gap analysis was completed. A draft action plan identifies the programmatic requirements necessary to demonstrate the management and deployment of safety basis requirements.
- ◆ The revision has been completed to enhance the criticality safety engineer training and qualification program addressing the guidance provided in DOE-STD-1135-99, Guidance for Nuclear Criticality Safety Engineer Training. The program is institutionalized in PNL-MA-250, *Criticality Safety Manual*.
- ◆ A baseline self-assessment was scheduled and performed on the Building Fire Appraisal (BFA) process to identify options to streamline and/or enhance the process. This action was taken because of the changes that have occurred with the order requirements and the need to ensure that the BFAs are performed in a timely manner.

#### Training and Qualification

- ◆ Results of the Training and Qualification (T&Q) FY2001 Performance Agreement with DOE-AMT indicate that the T&Q Management System performed at an "Outstanding" level again this year.
- ◆ The T&Q Management System performed a maturity assessment using the Management System Maturity Evaluation Tool. The overall average score is 5.6, which indicates that the T&Q management system is "highly mature and well operated."
- ◆ The T&Q Management System undertook two significant upgrades to systems and tools in FY2002, including one funded as an Operational Improvement Initiative (OII). The PeopleSoft Human Information System software was upgraded to version 8, which resulted in T&Q redeploying all previous training information tools via a web browser interface. Also, the OII-funded Staff Development and Training Tool Upgrade was completed, which resulted in a much-improved tool renamed Job Evaluation Training System (JETS).
- ◆ In addition to the 36 planned self-assessments, nine *ad hoc* assessments were conducted in FY2001. The results of these assessments have indicated the following improvements could be made: the number of staff taking Radiological I/II training may be reduced by using an escort, the number of staff taking annual eight hour HazWOper refresher training could be reduced by about 10%, and managers, supervisors, and Cognizant Space Managers need additional training on their R2A2, related to ES&H.

#### Environmental Management Services

- ◆ Developed and deployed a Waste Service Center to streamline the billing process to waste generators based upon Waste Operations acceptance of the waste versus receipt at the burial grounds or storage facility. This allows for efficient and timely closeout of projects as well as a way to accrue costs across fiscal year boundaries for waste disposal.

- ♦ Waste reduction means decreased programmatic costs and reduced long-term liabilities for the Laboratory. During FY2001, we developed and deployed numerous waste reduction activities including: development and deployment of the Waste Forecasting Tool; development and deployment of the Waste Planning Tool; and implementation of the Waste Neutralization program. In addition, we saw significant increases in waste volume treated in the Hazardous Waste Treatment Unit (HWTU), and the efficiencies gained from collecting and bulking waste at 305-B and the HWTU.
- ♦ Field Service Representatives now support all PNNL laboratories. This required establishing an FSR at Sequim and completing the transition of all Richland laboratories (including LSL II) from line provided hazardous material coordinators to EMSD provided field service representatives. This completes a five-year program to transition to FSRs and ensure a consistent, compliant, and focused waste management program.
- ♦ Worked with DOE-AMT and HQ-SC staff to establish PNNL site specific Pollution Prevention goals in response to the Secretary's November 12, 1999 Memorandum "*Pollution Prevention and Energy Efficiency Leadership Goals for Fiscal Year 2000 and Beyond*," and DOE Notice 450.4 "*Assignment of Responsibilities for Executive Order 13148, Greening the Government Through Leadership in Environmental Management*." The referenced documents established aggressive complex-wide waste reduction goals based upon a FY1993 baseline year. PNNL is on track, or exceeding its commitment, to reduce current generation waste streams in support of these complex-wide objectives.
- ♦ PNNL received the White House "Closing the Circle" Award for its reuse accomplishments. In addition, PNNL's reuse accomplishments received a runner up award at the DOE National Pollution Prevention Conference. PNNL, teamed with other Battelle components, received EPA's "Waste Wise Champion" Award. PNNL received DOE National Pollution Prevention Awards in the categories of Out-

reach, and Sowing the Seeds of Change. Regulatory agency staff nominated PNNL for Washington State's Governor's Award for Pollution Prevention and Sustainable Practices.

- ♦ Real-time tritium monitoring via a newly developed web-based tool allows research and facility staff access to tritium monitoring data on the PNNL intranet. The tool provides immediate feedback to research staff, which helps to minimize tritium emissions consistent with the principles of ALARA. The web page was used by multiple Pacific Northwest personnel to identify and track a below-limits tritium release that occurred over a two-day period in January. The protracted release was well below the permit limits and CAM alarm set points and could have gone unnoticed for several days. The improved availability of the CAM data allowed research staff to identify the low level release and eliminate the source of the tritium emissions thereby minimizing the impact to the environment.

### Integrated Environment, Safety and Health

- ♦ Incorporated the Integrated Operations System (IOPS) as a formal element of PNNL's Integrated Environment, Safety, and Health Management System. This tool enhances research operations by integrating hazard identification and communication, identification and tracking of training requirements, hazard mitigation through self-assessment, detailed work practices, and user access authorization and control. Enhancements to both IOPS and the Standards-Based Management System now provide role-based access for researchers, managers, and support staff.
- ♦ Progress was made at integrating hazard analysis activities. In addition to making role-based enhancements, the IOPS Subject Area now defines responsibilities for hazard analysis and communication. The Hazard Analysis Initiative is a three-year project designed to make improvements in the identification, evaluation, and mitigation of environment, safety, and health hazards. The project integrates and improves existing tools like the Electronic Prep and Risk, the Standards Based Management System, and

the Integrated Operations System to enhance the role-based efficiency and effectiveness of research and development work planning and control. When complete, this tool can be expanded to address other issues relevant to research and development operations including security, quality, and property management. The project also anticipates the ability to deliver cost savings in terms of reduced labor for research and development work planning and fewer accidents and incidents. OII funding for both the IOPS and HAI initiatives will continue through FY2003.

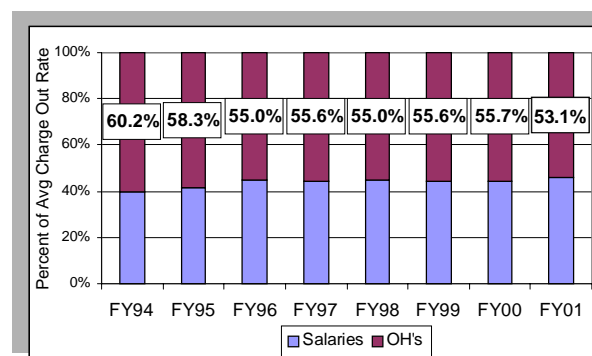
- ♦ **PNNL received the DOE VPP Superior Star Award.** This award acknowledges sites that: (1) achieve injury/illness incidence rates and lost workday injury/illness rates at least 50% below the Bureau of Labor Statistics national average for the Standard Industrial Classification/North American Industry Classification System code; (2) meet annual DOE-VPP goals; and (3) demonstrate strong involvement in VPP mentoring and outreach. PNNL is committed at all levels to the Voluntary Protection Program, established by DOE to recognize superior performance in health and safety. This program is a partnership between labor, management, and the government to promote worker safety through employee involvement. It involves worksite analysis, hazard prevention and control, safety and health training, management leadership, and employee involvement. PNNL is the first DOE Office of Science Laboratory to achieve Voluntary Protection Program Gold Star Status.

## Analysis

**Performance against business management sub-indicators.** PNNL is committed to providing high quality science and technology at a competitive cost. By focusing on continued cost improvement and establishing business indicators in our performance agreement with the DOE, we continually monitor and improve cost performance. These indicators provide evidence of the Laboratory's efforts to continuously improve its business management systems. It is composed of three sub-indicators. The first two help us monitor opera-

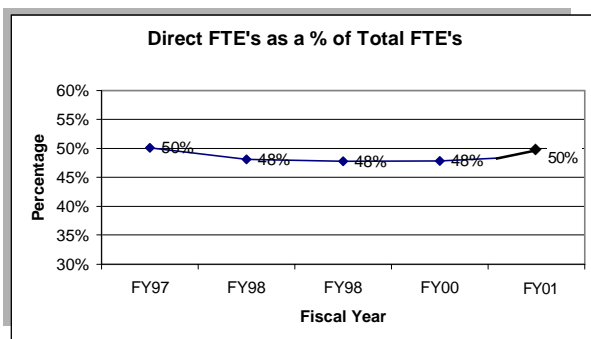
tional efficiency: Overhead costs as a percent of our fully burdened 1830 average charge out rate, and the Lab's percent of direct charging Full Time Equivalents (FTEs). These metrics reveal PNNL's ongoing effort to improve efficiency through business growth and optimizing overhead costs. The third sub-indicator is the annual evaluation of the Lab's business management functions by its DOE-RL counterparts.

**Overhead cost as a percent of the Laboratory's 1830 fully burdened average charge-out rate.** The 1830 fully burdened average charge out rate is the average cost our government clients pay for Laboratory staff labor. Optimizing the amount of this cost-driven by staff salary and benefits-makes us more competitive. Our long-term goal is a burdened charge out rate comprised of less than 50% overheads. Overhead costs in FY2001 were 53.1% of the total 1830 average charge out rate, outstanding compared to the target of 54% and prior year results of more than 55% (see Figure 2.3). Strong business performance and downward pressure on overhead rates account for these favorable results.



**Figure 2.3.** Historic Salaries and Overhead Costs as a Percent of Average Charge Out Rate

**Direct FTEs as a percent of the total Laboratory FTEs.** In addition to keeping overhead costs in check, we are shifting the balance of resources in the labs that are aligned with client funded R&D activities compared to support functions funded by overhead dollars. Figure 2.4 indicates that in FY2001 FTEs that charged directly to customers accounted for nearly half of the Laboratory's total FTE. This exceeds our target of 49% and is a



**Figure 2.4.** Historic Levels of Full Time Equivalent (FTE) Employees

demonstrated improvement of nearly three percentage points since FY2000. Strong business performance and downward pressure on overhead rates account for these outstanding results as well.

In addition to the business management sub-indicators discussed above, this indicator also considers the effectiveness and performance of the Laboratory's business management functions in delivering products and services, and in complying with applicable requirements. Our performance in this area is determined by the cognizant DOE-RL business management organization during the annual 2-Week DOE-RL Review. These scores are not available as of this printing. We believe, however, that our performance over the past year will be evaluated as **Outstanding**.

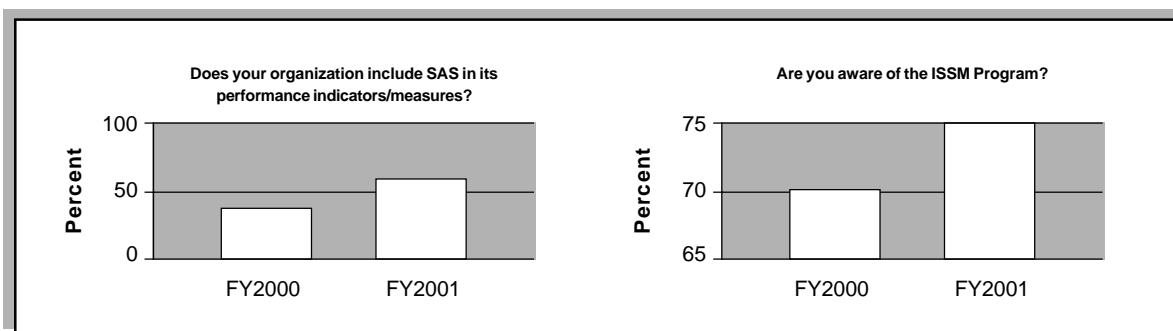
## Analysis

**Sustain and enhance effectiveness of integrated Safeguards and Security (SAS).** This

indicator demonstrates the degree to which the requirements and practices of the Safeguards and Security management system are integrated into the day-to-day operating culture of the Laboratory. It is composed of four sub-indicators. Performance against these sub-indicators has met or exceeded the FY2001 performance targets resulting in an Outstanding rating in the area of Safeguards and Security.

**SAS is integrated into the culture of the organization for effective deployment of the management system.** All milestones/objectives for the Integrated SAS Management Program (ISSM) have been completed according to schedule. The SAS survey shows that integration into the Laboratory culture is becoming more complete by the increase in positive results seen in this year's Safeguards and Security survey. Figure 2.5 provides a summary of these results.

All SBMS materials were reviewed in accordance with internal schedules, and Records of Decision (RODs) were completed. PNNL Independent Oversight group completed an internal assessment on the deployment of ISSM. This assessment indicates that management support, and ongoing dialog and analysis by line managers continues, improving the deployment the Integrated Safeguards and Security Management (ISSM) System to staff. Staff knowledge of requirements and awareness is high and they feel they are being kept up-to-date on issues and requirements. The SAS management is highly regarded by the line organizations for



**Figure 2.5.** Summary Results of ISSM Survey FY2000 vs FY2001

customer focus and commitment to ISSM deployment. Areas of improvement include increasing the line organizations' incorporation of SAS into their internal assessments. The documented results of this assessment will be delivered during the first quarter of FY2002.

**Safeguards and Security (SAS) training and knowledge are commensurate with assigned responsibilities.** Excellent work was done by the line organizations to ensure that all appropriate staff were current with Safeguards and Security requirements. A composite fiscal year performance score of 93.9% indicates that nearly all staff are current with applicable SAS training requirements.

**External evaluations of performance in SAS programmatic areas reflect satisfactory protection of assets and compliance.** Three external evaluations of SAS took place during FY2001. Each resulted in a "satisfactory" or greater composite rating. Quite often a "satisfactory" or "meets expectations" rating is the highest rating given by various assessing organizations in the Safeguards and Security world.

- ♦ The DOE-HQ (SO-322) review was held on the topic of communications security and emissions control programs. The Laboratory's program received an "excellent" rating.
- ♦ The Office of Nuclear and National Security Information (ONNSI) and DOE-HQ (SO-22) reviewed classification appraisal of DOE-RL, which included PNNL. This evaluation resulted in a "meets expectations" rating - the highest rating available.
- ♦ DOE Office of Independent Oversight and Performance Assurance performed an inspection of all topical elements of our SAS program, including physical security, cybersecurity, personnel security, security program management, and more. The overall rating was "satisfactory," again, the highest rating awarded.

**Emerging threats are identified, reported, and mitigated as necessary.** The number of reportable incidents of security concern has declined – eight in FY1999; four in FY2000; and one in

FY2001. This exceeds our goal of maintaining less than six reportable incidents (the average of the previous two years). Eight corrective actions associated with the FY2001 reportable incidents have been developed and completed as scheduled. The Integrated SAS program has been a significant contributor to fewer security incidents (due to significant line participation).

## 2.2 Optimize Capability Alignment with Current and Future Mission Needs

### Results

This objective served to focus the Laboratory on working in partnership with the Department of Energy to develop an integrated approach to capability development that considers staff technical capabilities in connection with associated facilities and equipment. The indicators this year helped the Contractor make progress in enhancing the internal processes necessary to understand current and future mission needs, and then to obtain or develop the needed staff, facilities, and equipment capabilities. It should be noted that it may take more than one year to characterize the capability baselines, formalize the necessary planning processes and analyses, and establish the mechanisms to provide staff enhancement and new or refurbished equipment or facilities.

Efforts to assess and enhance the Laboratory's process for characterizing its technical capabilities resulted in a more comprehensive analysis and subsequent action plans to continue to ensure the necessary alignment with current and future science and technology needs. A joint effort with DOE refined a documented approach for this process. Technical Network and other business plans were analyzed to identify capability gaps and the actions needed to close these gaps. Not only were gaps and actions identified in FY2001, but significant improvements relative to capability stewardship were also accomplished in FY2001. Establishing a technical network management approach and making routine assignments accomplished further definition of capability stewardship.



Focus on the execution of the Facilities Strategic Plan ensured outstanding performance in achieving all seven of the critical milestones resulting in continued progress toward the infrastructure needs to achieve the vision of the Laboratory for the 21<sup>st</sup> Century. This progress builds upon the previous years' efforts to improve the Facilities Strategic Plan by extensive partnering between the Facilities Directorate and all the research divisions.

PNNL conducted a multi-organizational survey of research equipment as part of a broader initiative to manage and renew the critical equipment needed to meet DOE's mission objectives. Coupled with the technical network business plan analysis, the process instituted to manage critical equipment delivers an integrated view of the equipment, facilities, and staff capabilities currently maintained and/or needed in the future in order to meet future mission needs.

Based upon the performance indicators that support this objective, our rating for FY2001 is **Outstanding**.

### Analysis

#### **Develop and establish a process for characterizing the Laboratory's technical capabilities.**

This indicator demonstrated Battelle's ability to assess the Laboratory's current technical capabilities relative to DOE's current and future science and technology needs and to establish processes to respond to those assessments. The Laboratory worked with DOE-RL to refine its documented approach and begin a more comprehensive analysis of the technical network and other business plans. This includes reviewing capability gaps identified in Level 1 plans, Laboratory-level investments, and product line and sector plans. This resulted in the identification of gaps and areas for improvement. In addition to identifying gaps, the Laboratory was also able to make significant improvements during FY2001. These include establishing the technical network management approach, revising some planning templates to address information gaps, funding of additional technical network SWOT analyses, and the creation of new planning tools to better communicate capability information.

Specific actions taken to address capability gaps include:

- ♦ Directing LDRD funds toward highest priority capability needs
- ♦ Recruiting staff to support initiative thrust areas
- ♦ Allocating GRE funds to identified equipment gaps
- ♦ Allocating incremental funds to several capability areas at midyear

**Effective execution of the Facilities Strategic Plan to provide the facility space and infrastructure needed to achieve the vision of the Laboratory for the 21<sup>st</sup> Century.** This indicator demonstrated Battelle's ability to provide the facility space and infrastructure needed to achieve the vision of the Laboratory for the 21<sup>st</sup> Century. During FY2001 the Laboratory made outstanding progress in achieving strategic objectives in the September 2000 Facilities Strategic Plan. The following outcomes and their corresponding milestones have been met for FY2001:

### Acquisition

- ♦ Acquisition and 90% occupancy of approximately 20,000 sq. ft. of space in Sigma II by June 30, 2001. Full occupancy was reached in the third quarter, on schedule. The operational objective of providing additional space to permit activation of the Local Area Island (LAI) in EESB was achieved in the second quarter.
- ♦ Construction of the User Housing Facility was completed on or before June 30, 2001, on schedule. We did not however, achieve full cost recovery this fiscal year. One goal for FY2002 is to achieve full cost recovery.

### Revitalization of existing infrastructure

- ♦ Definitive design and start of construction of FY2001 GPP funded renovations to four labs in 331 was completed by June 30, 2001. Design was completed on March 21<sup>st</sup>, and construction was started on April 10<sup>th</sup>, ahead of schedule.
- ♦ Prepared, submitted, and presented Justification of Mission Need (CD-0) for FY2003 DOE Office of Science Line item-Laboratory

Systems and Rehabilitation Upgrade on December 14<sup>th</sup>, 2001.

- ♦ A project plan that integrates the switchgear and HVAC Controller replacement projects in the RPL was submitted for approval during the 1<sup>st</sup> Quarter, on schedule. Approval was received from Paul Kruger on January 12, 2001.
- ♦ A project to replace the switchgear and HVAC Controller in RPL within 30 days of baseline plan approval was initiated on February 6, 2001, ahead of the February 12<sup>th</sup> deadline.

### Campus of the future

- ♦ An implementation plan defining Battelle's strategy to address the interim space needs for biology facilities by September 30, 2001 was completed on schedule. Interim facility requirements have been identified and balanced with available capacity. A gap analysis has resulted in detailed plans and logic flows for bridging the gap to the new biology facilities.

**Establish a Laboratory-wide approach to manage/renew the critical equipment (i.e. those with a capital value >\$100K) needed to meet DOE's mission objectives.** This indicator demonstrated the contractor's ability to ensure the Laboratory has the necessary equipment to meet DOE's future mission needs. A crosscutting team was used to develop an assessment questionnaire to obtain accurate information on existing equipment. Aided by equipment custodians across the Laboratory, 78% of the operational condition assessments were completed. The information collected included

- ♦ Time utilized/time available
- ♦ Current age and an estimate of expected usable life
- ♦ Current user base
- ♦ Estimate of capacity/time available for other programs
- ♦ A list of the equipment's capabilities
- ♦ An evaluation of ability of the current design capabilities or operational condition to support mission objectives.

A database with the initial baseline has been developed from survey data in order to document the percentage of excess capacity the laboratory has available. The conclusion from review of the data is that there are few instances of equipment being underutilized. In the few cases where equipment is underutilized, the equipment has been transferred to a university or other worthy user, or declared excess. In addition to the equipment surveys performed, an assessment determined that no changes to SBMS are needed at this time.

## 2.3 Provide an Integrated Management System That Enables PNNL Mission Execution While Providing Stewardship of DOE Assets

### Results

In FY2001, in support of our continuing efforts to streamline and improve the operational aspects of how the Laboratory delivers products and services to its customers, thus minimizing the overhead impact to research staff, we focused on two efforts: the first, understanding how mature our management systems were, and the second, understanding how our current management systems could evolve into the next generation of management systems.

Both of these efforts yielded significant information about our internal processes. The first involved the assessment of each management system, using a formally developed five-category Maturity Questionnaire that was then scored. Overall, PNNL's management systems scored an average of 3.6 on a scale of 1 to 6. Translated, this equates to a median "Basically Effective" adjectival rating. "Basically Effective" is the third of six Maturity Levels, categorized into three major topical areas: Approach, Deployment and Performance Results. "Basically Effective" management systems typically display:

- ♦ A systematic approach to developing key processes, products and services, and sometimes use customer input to do so,
- ♦ System ownership responsibilities that are generally carried out, but have some aspects of ownership that may be in early stages of deployment,

- ♦ End-user responsibilities that are generally carried out although some work units may be in early stages of deployment,
- ♦ Early stages of performance metric development and use of comparative information,
- ♦ Results that are reported for most areas important to the host organization's business requirements, and
- ♦ Performance levels that meet targets established in areas important to the host organization's business.

Overall, scores for individual management systems ranged from 2.2 to 5.6.

We also focused significant efforts at developing the architecture for the Second Generation Management Systems. This involved articulating the work flows of the Customer Service Model, defining and prioritizing a "product" list of systems, processes and tools that would be used to continue the development of the 2<sup>nd</sup> Generation Management System, and formally documenting the architecture of the Second Generation Management Systems.

The term "Second Generation Management Systems" is the Laboratory's vision to ensure that we have support processes and staff, facilities and infrastructure, and information technology tools available to enable science and technology research at PNNL. The Drawing the Road Map to Second Generation Management Systems OII activities confirmed that the overall operational design and performance expectations for the Second Generation Management Systems approach needed to simply be a more fully expressed articulation of our first-generation design. We believe our first generation management system concepts to be generally sound and to require only fine-tuning.

Our performance toward this indicator demonstrates the Laboratory's continuing ability to drive improvement in targeted areas while sustaining and even enhancing performance as a whole.

Based upon our performance against the indicators that support this objective, our rating for FY2001 is **Outstanding**.

## Analysis

**Baseline the effectiveness of management systems deployment.** This indicator was designed to establish a baseline evaluation of the effectiveness of management systems deployment throughout the Laboratory for use in FY2002 planning. Efforts at completing this evaluation resulted in the development of a framework for evaluating management system effectiveness and identification of improvement areas. The framework was used to analyze the results of self-assessments and to identify potential areas where improvement is most critical.

Each management system completed the evaluation questionnaire and the results were evaluated using a five-category framework based on the Baldrige National Quality Award Criteria for Performance Excellence. PNNL's management systems scored an average of 3.6 on a scale of 1 to 6. Translated, this equates to a "Basically Effective" adjectival rating. Scores for individual management systems ranged from 2.2 to 5.6.

As a result of the efforts described above, two FY2002 Operational Improvement Initiative proposals were developed for carrying forward the FY2001 OII results related to Second Generation Management Systems. These are PNNL Intranet - Cleaning Up the Delivery of On-line Information to Staff, and Implementing the Road Map to Second Generation Management Systems.

In addition to the OII proposals submitted to enhance our understanding and implementation of the maturity of the Laboratory's management systems, the Quality Directorate's FY2002 Level 1 Business Plan contains actions necessary to complete the following:

1. Update and clarify the Maturity Evaluation questionnaire as appropriate.
2. Summarize and "post" the results of FY2001 maturity evaluations and scores.

3. Integrate the Maturity Evaluation with the Management System Peer Review and business planning process.
4. Establish maturity target levels for each management system through a series of facilitated interactions with management systems and research staff users.
5. Develop a performance indicator for Management System Maturity that can be used to demonstrate progress towards established targets.
6. Initiate the second year of maturity evaluations for all management systems.

By developing and applying a common framework to determine the maturity of each management system (using their processes and the results of self-assessments), we can assess the management and maturity of our entire set of management systems. By comparing the current maturity with the “ideal” maturity for each management system, we can begin to make decisions regarding investments in improvement initiatives or cost-efficiency challenges. Thus, we will be able to achieve an optimal balance between the effectiveness of our management systems and the expenditure of resources. As a result of the above efforts, we have completed all of the metrics specified in the FY2001 Performance Agreement for an Outstanding rating for this indicator.

#### **Progress toward the development of the Second Generation Management Systems.**

This indicator focused our efforts at developing the architecture for the Second Generation Management Systems, defining and prioritizing a “product” list of systems, processes and tools that would be used to continue the development of the Second Generation Management Systems, and formally articulating the work flow of the Customer Service Model.

An FY2001 Operational Improvement Initiative titled *Drawing the Road Map to Second Generation Management Systems* was initiated. Throughout the year, we worked with product line managers, relationship managers, and capability stewards to define

the workflows for the expert delivery, relationship management, and capability stewardship functions within the Customer Service Model. The results of this effort are summarized in a document titled *Mapping the Customer Service Model as a Foundation for a Second Generation Approach to Management Systems*.

The Drawing the Road Map to Second Generation Management Systems OII activities confirmed that the overall operational design and performance expectations for the second-generation management systems approach needed to simply be a more fully expressed articulation of our first-generation design. Our conclusions are

- ♦ PNNL’s first generation management system concepts were generally sound and require only fine-tuning.
- ♦ We do not need to start over with a revolutionary redevelopment of our management systems. The path to “second generation management systems” will generally involve the work of maturing existing systems and making a few targeted improvements in both systems and delivery mechanisms.
- ♦ The most fertile ground for improvement relates to the self-assessment approaches generally employed by the management systems. Maturing the self-assessment approaches will provide the information necessary to strengthen system implementation and performance.

The SBMS architecture elements follow:

The term “Second Generation Management Systems” is our laboratory vision to ensure that we have support processes and staff, facilities and infrastructure, and information technology tools available to enable science and technology research at PNNL.

Through the SBMS record of decision process, management system owners and line organizations work to ensure applicable and appropriate requirements that can be implemented are delivered through management system products and services.

Management systems deliver the entire operating infrastructure needed to manage and operate PNNL in conformance with the operating contract, Battelle Memorial Institute (BMI) policies, and other applicable and appropriate requirements.

Organizations manage the people who do work for our internal and external customers, which requires us to more clearly articulate role distinctions between:

- ♦ management systems, with the role of defining the Lab-level requirements and providing systems, processes, and tools that enable the staff to implement those requirements, and
- ♦ support organizations, with the role of providing technical expertise to help the line carry out their work.

Management system owners are responsible for maintaining comprehensive self-assessment activities that provide an understanding of customer satisfaction, external requirement conformance, and the implementation/deployment status of their subject areas, processes, and products. The results of these self-assessment activities are used to continuously improve management system performance.

Management systems deliver an appropriate set of real-time performance data for use by the line organizations in their self-assessment programs.

Line organizations are responsible for maintaining self-assessment activities that are designed to meet their business needs and are adequate for monitoring their organization's compliance with applicable PNNL requirements.

Independent Oversight provides Level 1 managers with technical reviews of the effectiveness of self-assessment plans and activities.

Subject matter experts do not conduct oversight or auditing, but may be employed by the line managers or system owners for assistance in the execution of their respective responsibilities (including self-assessment activities.)

Line managers are solely accountable for ensuring that staff members conduct work in accordance with procedures in SBMS.

PNNL Level 1 managers are responsible for and accountable to the PNNL Laboratory Director for the integrity with which the above elements are discharged within their organizations.

The OII developed a set of design criteria by which PNNL determines the need for, and existence of, a management system. These criteria are articulated by a set of prerequisite criteria for what a management system is, what a management system is not, and finally, for governing the content of a Management System

The new architectural feature, a derivative of Brookhaven National Laboratory's (BNL's) Management System architecture, involves "housing" all system delivery mechanisms within a management system framework. These delivery mechanisms include the use of standing committees, subject matter experts (SMEs) - for those systems where the content is sufficiently specialized that SMEs are appropriate to efficiently deliver services, training, electronic tools, and subject areas.

An FY2002 OII Proposal for carrying forward the FY2001 OII results related to Second Generation Management Systems titled Implementing the Road Map to Second Generation Management Systems was submitted for funding consideration.

### **Management and Operations Excellence Performance Rating**

The overall performance rating for the Management and Operations Critical Outcome is determined by comparing the total value for the outcome, as determined in Table 2.2, to the rating table in Table 2.3.



**Table 2.2.** Operational Excellence Critical Outcome Performance Rating Development

Element	Adjectival Rating	Value Points	Indicator Weight	Total Points	Objective Weight	Total Points
<b>2.1 Operational Excellence</b>						
<b>2.1 Provide management and operational excellence in achieving key contact provisions.</b>						
2.1.1 Effectiveness of Integrated Safety Management (ISM)	Outstanding	5	25%	1.25		
2.1.2 Performance against business management sub-indicators	Outstanding	5	35%	1.75		
2.1.3 Sustain and enhance the effectiveness of Integrated Safeguards and Security	Outstanding	5	40%	2.0		
Obj 2.1 Total				5.0	40%	2.0
<b>2.2 Optimize capability alignment with current and future mission needs.</b>						
2.2.1 Develop and establish a process for characterizing the Laboratory's technical capabilities	Outstanding	5	40%	2.0		
2.2.2 Effective execution of the Facilities Strategic Plan to provide the facility space and infrastructure needed to achieve the vision of the Laboratory for the 21st Century	Outstanding	5	30%	1.5		
2.2.3 Establish a Laboratory-wide approach to manage/renew the critical equipment (i.e., those with a capital value >\$100K) needed to meet DOE's mission objectives	Outstanding	5	30%	1.5		
Obj 2.2 Total				5.0	40%	2.0
<b>2.3 Provide an integrated management system that enables PNNL mission execution while providing stewardship of DOE assets</b>						
2.3.1 Baseline the effectiveness of management systems deployment	Outstanding	5	50%	2.5		
2.3.2 Progress toward the 2 <sup>nd</sup> Generation Management Systems	Outstanding	5	50%	2.5		
Obj 2.3 Total				5.0	20%	1.0
Outcome Total						5.0

**Table 2.3.** Operational Excellence Critical Outcome Final Rating

Total Score	5.0 - 4.5	4.4 - 3.5	3.4 - 2.5	2.4 - 1.5	<1.5
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

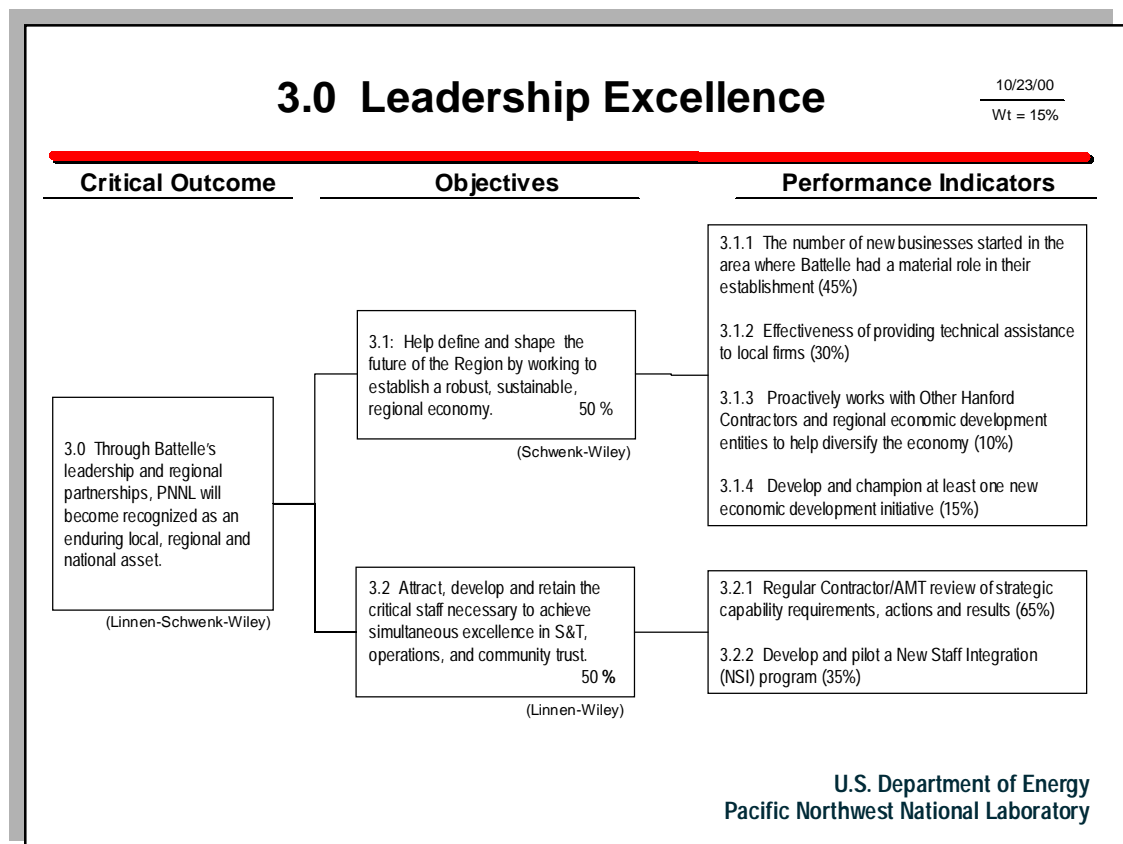
## 3.0 Leadership Excellence

We recognize that the heart of the Laboratory is made up, not of facilities and equipment, but of our research and support staff. World-class science and technology requires world-class scientists and engineers. We are dedicated to attracting and retaining exceptional scientists and engineers that will enable us to continue our pursuit of science and technology excellence.

The Department of Energy has made a strong commitment to help local economies transition to a post-cleanup world in which thousands of DOE-supported jobs will disappear and must be replaced by private-sector activities. Just as

PNNL's business mission underlines its role of advancing technology in the Northwest Region, so too does PNNL's commitment to the local communities drive its efforts to serve the neighborhoods in which our staff live and work, the local multi-county region and the entire Pacific Northwest through economic development efforts.

For these reasons, and in partnership with DOE, the Laboratory established the Leadership Excellence Critical Outcome, and its supporting objectives, and performance indicators, presented below, to guide our efforts and monitor our progress.



## Summary

Battelle staff, leaders and managers are making a difference within the DOE Complex, Pacific Northwest National Laboratory and the community. We are helping create a diversified regional economy by putting technology to work in the Tri-Cities region. In FY2001 we launched, or helped launch, eight new businesses, bringing our five-year total to 50, and we provided technical assistance to 43 additional businesses. Fully 100 percent of the technical assistance recipients surveyed indicated that they were satisfied or better with the utility of the assistance provided and with the interaction process, providing solid feedback that our technical assistance program is delivering what the customer needs. This was our best survey ever.

We have worked with Other Hanford Contractors and other regional entities such as TRIDEC and the Alliance of Angels/Technology Alliance, to help diversify the local economy. We took an active role in TRIDEC's efforts to develop an economic development strategic plan. We developed a significant relationship with the Biotechnology Association of the Spokane Region, and we have assisted the Tri-Cities Venture Group to grow, filling a significant need within the community. In addition, we developed and championed a number of new economic development initiatives.

We are seeking the best scientific and engineering minds available and are bringing them to the Lab to join our pursuit of scientific and technological excellence. We identified 14 strategic positions in FY2001 and filled 12 of those positions. Fifty percent of the positions were filled with internal candidates through our succession planning process and 50 percent were filled from outside the Lab. Thirty-three percent (33%) of the positions were filled by women and eight percent (8%) were filled by minority candidates.

Once new staff get here, our New Staff Integration program exposes them to a wide-range of topics ensuring that new staff and managers integrate into the Laboratory faster, thus increasing

staff commitment, understanding of the Lab and its programs, and productivity during the first year.

Based upon our progress toward the Objectives that support this Critical Outcome, we believe our FY2001 performance rating is **Outstanding**.

### 3.1 Help Define and Shape the Future of the Region by Working to Establish a Robust, Sustainable, Regional Economy

#### Results

We have had another outstanding year at putting technology to work in the Tri-Cities region in FY2001. We launched, or helped launch, eight new businesses, bringing our five-year total to 50, and we provided technical assistance to 43 additional businesses. Fully 100 percent of the technical assistance recipients surveyed indicated that they were satisfied or better with the utility of the assistance provided and with the interaction process, providing solid feedback that our technical assistance program is delivering what the customer needs. This was our best survey ever.

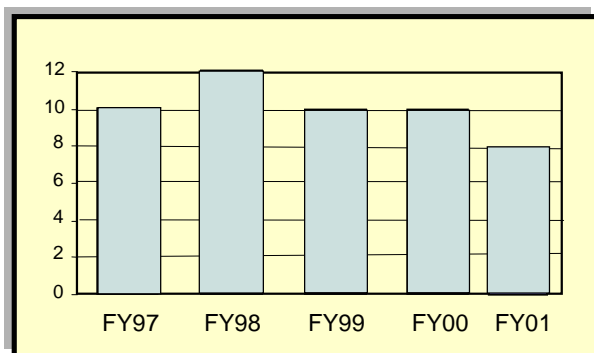
Other efforts aimed at diversifying the regional economy included working with Other Hanford Contractors and regional entities such as TRIDEC and the Alliance of Angels/Technology Alliance. We took an active role in TRIDEC's efforts to develop an economic development strategic plan. We developed a significant relationship with the Biotechnology Association of the Spokane Region, and we have assisted the Tri-Cities Venture Group to grow, filling a significant need within the community.

Our efforts at diversifying the local and regional economy didn't stop with our engagement with existing entities and in existing programs. We actively sought out new approaches and initiatives for economic development and championed 11 initiatives.

Based upon our performance against the indicators that support this objective, we believe our rating for FY2001 is **Outstanding**.

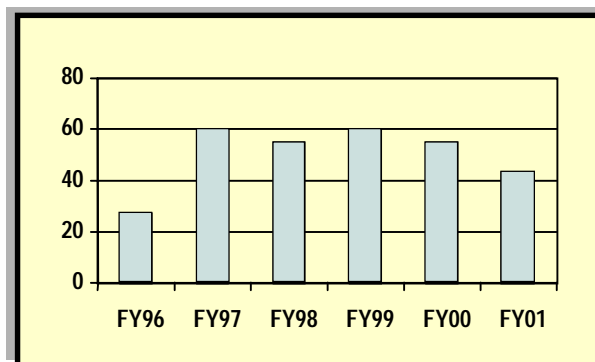
## Analysis

**The number of new businesses started in the local area where Battelle had a material role in their establishment.** We are helping create a diversified economy by putting technology to work in the Tri-Cities region. Results are presented in Figure 3.1. In FY2001 we launched, or helped launch, eight new businesses, bringing our five-year total to 50. These businesses have included a start-up manufacturer of cast-iron brake drums for trucks and other large vehicles, a start-up biotechnology company, and a soil testing laboratory that has expanded into the treatment of dairy wastes in lagoons. See Table 3.1 for a short description of each new business start for FY2001.



**Figure 3.1.** The Number of New Business Starts and Expansions by Fiscal Year

**Effectiveness in providing technical assistance to local firms.** – PNNL technical staff provided technical assistance to 43 local and regional businesses in FY2001, bringing our five year total to nearly 300 technical assistances offered. Results are presented in Figure 3.2. Results of an end-of-year survey of the businesses assisted in FY2001, assessing the effectiveness of our assistance, indicated that fully 100% of the technical assistance recipients surveyed were “satisfied or better” with the utility of the assistance provided and with the interaction process. This annual survey provides solid feedback that our technical assistance program is delivering what the customer needs. The results from this survey were our best ever.



**Figure 3.2.** PNNL Technical Assistance Projects by Fiscal Year

**Proactively work with Other Hanford Contractors and regional entities to help diversify the local economy.** In addition to our efforts to diversify the local economy by starting or helping create new businesses and by providing technical assistance to existing companies, we have had a successful year of teaming with Other Hanford Contractors to diversify the economy. PNNL staff have worked with numerous non-PNNL entities throughout the year to lead or assist in local economic diversification efforts. A small sample of the more than 30 specific activities accomplished during FY2001 follows.

- ♦ PNNL took an active role in TRIDEC's efforts to develop a community-based economic development strategic plan, as both a major sponsor and as a participant. This effort is currently known as the Community Roundtable. PNNL staff participated in TRIDEC's facilitated strategic planning workshops.
- ♦ Economic Development Office (EDO) staff remain active in TRIDEC's business retention and expansion program, known as CARE (Commerce Appreciation, Retention, & Expansion), from the initial planning meetings, through data collection surveys, and leading one of the task forces formed to address shortcomings identified in the surveys.

Table 3.1. PNNL-Assisted New Business Starts for FY2001

1. **Durametal Brake** — A start-up manufacturer of cast-iron brake drums for trucks and other large vehicles. PNNL provided technical assistance in getting the brake foundry started.
2. **Mobile Foundations** — A provider of hardware, software, and services that developed a wireless system to help organizations manage emergency response situations. The technology developed by MobileFoundations was initially developed for NASA by the company's founder while employed at PNNL, and subsequently licensed. The founder has since taken an Entrepreneurial Leave of Absence, along with another staff member who leads product development in Richland.
3. **Northwest Ag Products** — Produces bio-technical chemistry products to support plant health for industrial and agriculture industries. PNNL helped NAP expand its product line through technical assistance to develop and produce new bio-technical products.
4. **PhytaGenics** — A start-up biotechnology company that discovers, develops, and manufactures pharmaceutical products from genetically modified plants. Five of the founders are PNNL staff members on entrepreneurial leave. PhytaGenics also received support from PNNL in the form of a license for its foundation technology, technical assistance, and access to laboratory space.
5. **Soil Search** — A soil testing laboratory that Battelle helped expand into the treatment of dairy wastes in lagoons. Battelle helped Soil Search expand by licensing its InStream technology, providing technical support, helping to implement a demonstration of the technology at a local dairy, and publicizing the success of the demonstration.
6. **sZen Corp** — A provider of software and hardware for managing golf courses and other recreational and retail establishments. PNNL assisted sZen in a number of ways, including a technical assistance effort to develop object-oriented applications, funding a market study by WSU MBA students, and recruiting and coaching sZen to participate in an investor forum hosted by the Lab.
7. **Veach Company** — A developer and manufacturer of various pieces of high-end equipment for photography studios, including a machine for embossing metallic lettering on books and such. Through technical assistance, PNNL staff members helped Veach automate its hot-foil-stamping machine, resulting in significantly increased sales.
8. **Wave ID** — A start-up firm initially located in Richland that develops and sells wireless communications systems based on radio-frequency identification technologies. Wave ID was founded by Battelle and five former staff members to commercialize technology licensed from Battelle.



- ♦ PNNL initiated and developed a significant relationship with the Biotechnology Association of the Spokane Region (BASR). We started by hosting a visit by Patrick Jones, the Executive Director of the BASR. The BASR is interested in the Tri-Cities because of the biotech activity here. As a result of the visit, PNNL hosted a tour of 31 business leaders from the Spokane Economic Development Council and the BASR who wanted to learn about biotechnology-related opportunities at PNNL and in the Tri-Cities.
- ♦ *Mucho Dinero 2001*, a seminar co-sponsored with KONA Radio, was held at the Columbia Basin Advanced Technology Center at Columbia Basin College (CBC). The seminar was organized by PNNL staff from the Economic Development and Communications Directorate and community partners. Fifty-eight people from the Tri-Cities, Benton City, Walla Walla, and Yakima heard from four business owners and consultants from the Portland and Seattle areas about how to expand into each other's markets. Seventy-five percent of attendees gave the seminar the highest rating, "very useful."
- ♦ PNNL implemented a high-bandwidth video conferencing capability between the Lab and the Spokane Intercollegiate Research and Technology Institute to facilitate interactions between Tri-Cities technologies and Spokane business resources.
- ♦ EDO staff worked with the Washington Technology Center, Washington Office of Trade and Economic Development, The Washington Small Business Development Center, the Spokane Intercollegiate Research and Technology Institute, and private contractors to submit a successful proposal to the Federal and State Technology (FAST) Program. The FAST Program is a federally supported effort to help states help firms win more SBIR grants. The Washington proposal was awarded \$100,000.

- ♦ An EDO staff member was named the first-ever Honorary Member of the Alliance of Angels in recognition and support of EDO's successful efforts to increase deal flow for the AoA from eastern Washington firms.
- ♦ EDO staff helped plan and arrange the technical program for the second annual Early Stage Investor Forum held in Seattle in March. The ESIF was hosted by a number of investor groups, technology agencies, and venture clubs. At the ESIF, about 300 investors heard business plans from 17 entrepreneurs.
- ♦ EDO staff provided a presentation to the Governor's Small Business Improvement Council.

These are but a few examples of the type of efforts PNNL staff engage in on behalf of the economic diversity of the local community.

**Develop and champion at least one new economic development initiative.** Our efforts at diversifying the local and regional economy didn't stop with our engagement with existing entities and in existing programs. We actively sought out new approaches and initiatives for economic development. A sample of the 11 initiatives undertaken during FY2001 follows.

- ♦ PNNL organized and hosted the Alliance of Angels Tri-City Investor Forum, with support from TRIDEC and the Columbia Basin Advanced Technology Center. At the Forum, two panels of Angel investors explained what businesses should do to be more appealing to private investors, and explained what private investors should look for in technology-based opportunities. Four local firms presented business plans to the Alliance, and one of those firms was selected to give its presentation to the entire Alliance membership in Seattle two weeks later. Attendance at the Forum was well over 100, with 160 attending the luncheon. Favorable media coverage resulted in television, radio, local

press, and national press. Feedback from attendees was overwhelmingly positive, and the Alliance is discussing the possibility of another forum here next year and/or a visit to PNNL. Eighty-three percent (83%) of the attendees found the investor forum very useful. Some quotes from attendees: “Fabulous presentations and panel discussion. Thank you!” and “I really appreciate having speakers of this stature to our area. Please continue to do more.”

- ♦ A new electronic newsletter, *Tri-Cities Tech Business Update*, was launched by the Economic Development Office (EDO). The monthly e-mailed newsletter covers news, tips, awards, and other information about local technology-based businesses and organizations that support them. At year-end, more than 550 technology-related businesses, investors and economic development stakeholders subscribed to the newsletter in the Mid-Columbia area and regionally. Feedback from subscribers has been very positive, with many saying that they appreciate a single source of local tech-company news.
- ♦ PNNL hosted a day long workshop, “Rainmaking in a Capital Drought,” in Richland on Aug. 30. Forty entrepreneurs and economic development stakeholders attended the sold out workshop. Many startup firms are having trouble obtaining equity capital in this dry financial climate. But according to three Seattle-area equity capital experts, there’s still money available for savvy “rainmakers” if they know what to do. A videotape of the workshop will be made available to local entrepreneurs via streaming video over the Web. Feedback from attendees was extremely positive, with 100% of the attendees rating the workshop either excellent or very good (most rated the workshop excellent).
- ♦ The report, *Tri-Cities, Washington, Innovation and Technology Index*, was completed. This report describes many of the characteristics that are important for technology-driven economic development, and assesses the degree to which the Tri-Cities exhibits these characteristics. The report also compares the Tri-Cities index to the

index done at the state level by the Washington Technology Center, and to characteristics of other selected metropolitan areas. While the report is favorable overall, a few areas for improvement are identified. The report will be released early next fiscal year after a release strategy is developed.

- ♦ EDO staff participated with other organizations in several initiatives to boost the renewable energy industry in the local area. Energy Northwest, PNNL, WSU, and BPA are starting the Northwest Energy Innovation Center, a “pre-incubator” for renewable energy technologies. PNNL and APEL are cooperating with Washington Technology Center on a renewable energy initiative.

## 3.2 Attract, Develop and Retain the Critical Staff Necessary to Achieve Simultaneous Excellence in S&T, Operations and Community Trust

### Results

In support of our goal to become a world class Laboratory, Battelle recognizes the need to seek out and attract the most exceptional scientific and engineering minds. To assure that we have the technical staff necessary to achieve our vision of the 21<sup>st</sup> Century Laboratory, we are constantly seeking the most exceptional scientific and engineering minds available. During FY2001, we identified 14 strategic positions, and filled 12 of those positions. Fifty percent of the positions were filled with internal candidates through our succession planning process and 50 percent were filled from outside the Lab.

To help new staff transition into the Lab as smoothly as possible, we have developed the Invitation to Excellence program. This program exposes staff and managers to a wide-range of topics ensuring that new staff are integrated into the Laboratory faster, thus increasing staff commitment, understanding of the Lab and its programs, and individual productivity during the first year. Staff participating in this program have given it an **Outstanding**.

Based upon our performance against the indicators that support this objective, our rating for FY2001 is **Outstanding**.

### Analysis

#### **Regular Contractor/AMT review of strategic capability requirements, actions and results.**

To assure that we have the technical staff necessary to achieve our vision of the 21<sup>st</sup> Century Laboratory, we are constantly seeking the most exceptional scientific and engineering minds available. We identified 14 strategic positions in FY2001 and filled 12 of those positions. The status of each of the strategic position was briefed to the Leadership Team monthly and discussed quarterly during Strategy Council meetings.

Demographics of the strategic positions filled during FY2001 include:

- ♦ Fifty percent of the positions were filled with internal candidates through our succession planning process and 50 percent were filled from outside the Lab.
- ♦ Thirty-three percent (33%) of the positions were filled by women
- ♦ Eight percent of the positions were filled by minority candidates
- ♦ The educational distribution included 10 PhDs and two BS degrees
- ♦ Position distribution included two Level 1 Managers (Dr. J.W. "Bill" Rogers and Dr. Reinhold C. Mann), six Other Management Positions, and four S&E Level 5 Positions

The Associate Laboratory Directors of the four Divisions, with the concurrence of the AMT Division Director, have rated our performance against this indicator as an overall **Outstanding**.

#### **Develop and pilot a New Staff Integration**

**(NSI) program.** PNNL can be quite overwhelming to new staff members transitioning into the Lab. To help smooth their transition, we have developed the Invitation to Excellence program. This program exposes staff and managers to a wide-range of topics ensuring that new staff are integrated into the Laboratory faster, thus increasing staff commitment, understanding of the Lab and our programs, and individual productivity during the first year. Among the topics covered are: DOE History, Battelle and PNNL - Past & Present, Lab Organizational Structure and Culture, and Implementing the Lab Agenda and Critical Outcomes.

The Invitation to Excellence program consists of a series of 60 to 90 minute seminars that are held during lunch time. The seminars are presented by members of the Leadership Team, managers and senior staff. Since its initial session on March 2, 2001, approximately 300 staff have participated in 26 sessions of the Invitation to Excellence program. Post-program evaluations indicate an average rating of 4.5 on a five point scale.

#### **Leadership Excellence Performance Rating**

The overall performance rating for the Leadership Excellence Critical Outcome is determined by comparing the total value for the outcome, as determined in Table 3.2, to the rating table in Table 3.3.

**Table 3.2.** Leadership and Management Excellence Critical Outcome Performance Rating Development

Element	Adjectival Rating	Value Points	Indicator Weight	Total Points	Objective Weight	Total Points
<b>3.0 Leadership and Management</b>						
<b>3.1 Help define and shape the future of the Region by working to establish a robust, sustainable, regional economy</b>						
3.1.1 The Number of new businesses started in the area where Battelle had a material role in their establishment	Outstanding	5	45%	2.25		
3.1.2 Effectiveness of providing technical assistance to local firms	Outstanding	5	30%	1.5		
3.1.3 Proactively works with Other Hanford Contractors and regional economic development entities to help diversify the economy	Outstanding	5	10%	0.5		
3.1.4 Develop and champion at least one new economic development initiative	Outstanding	5	15%	0.75		
Obj 3.1 Total				5.0	50%	2.5
<b>3.2 Attract, develop and retain the critical staff necessary to achieve simultaneous excellence in S&amp;T, operations, and community trust</b>						
3.2.1 Regular Contractor/AMT review of strategic capability requirements, actions and results	Outstanding	5	65%	3.25		
3.2.2 Develop and pilot a New Staff Integration (NSI) program	Outstanding	5	35%	1.75		
Obj 3.2 Total				5.0	50%	2.5
					Outcome Total	5.0

**Table 3.3.** Leadership and Management Excellence Critical Outcome Final Rating

Total Score	5.0 - 4.5	4.4 - 3.5	3.4 - 2.5	2.4 - 1.5	<1.5
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

## 4.0 Determining the Laboratory's FY2001 Performance Rating

Battelle's performance rating for FY2001 is developed by determining the year-end level of performance for each performance indicator, compared to the individual targets established in the FY2001 Performance Evaluation & Fee Agreement, Modification No. 328. This level of performance is then judged against the metrics developed for each performance indicator and an appropriate adjectival rating is assigned. The adjectival rating for each performance indicator is inserted into the Rating Table found at the end of each Critical Outcome section and Value Points are assigned, based on the following scale: Outstanding performance = 5 points; Excellent performance = 4 points; Good performance = 3 points; Marginal performance = 2 points; and Unsatisfactory performance = 1 point.

The Value Points are added to the Tables and are multiplied by the weight of each performance

indicator and then added to develop the Objective score. The Objective scores are then multiplied by the Objective weightings and are added to develop the overall score for the Critical Outcome. The values from the individual Critical Outcome tables found throughout this document are then transferred to Table 4.1 below, and summed to develop the Laboratory's overall FY2001 (adjectival) performance rating.

The individual (weighted) Critical Outcome scores are added to determine the overall Laboratory score. This value is compared against the ranges found in Table 4.2 below to determine the Laboratory's overall FY2001 (adjectival) performance rating.

All numbers are rounded to the nearest hundredth and carried forward to the final Laboratory-level rating, which is then rounded to the nearest tenth, using standard rounding convention.

**Table 4.1.** FY2000 Contractor Evaluation Score Calculation

Critical Outcome	Value Points	Adjectival Rating	Weight	Weighted Score	Total Score
Science & Technological Excellence	5.0	Outstanding	60%	3.0	
Management and Operations Excellence	5.0	Outstanding	25%	1.25	
Leadership Excellence	5.0	Outstanding	15%	0.75	
				Total Score	5.0

**Table 4.2.** FY2001 Contractor Adjectival Rating Scale

Total Score	5.0 - 4.5	4.4 - 3.5	3.4 - 2.5	2.4 - 1.5	<1.5
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory





## **Part II**

### **Summary of Laboratory Strengths and Areas for Improvement for FY2001**

## Overview

Pacific Northwest National Laboratory's (PNNL) vision is to be among the world's premier scientific institutions and research laboratories, conducting research at the interfaces of the physical, life, and information sciences and technology; known for solving the U.S. Department of Energy's (DOE) most critical and challenging problems, widely recognized for operational excellence, and highly valued by the community and region in which it operates. In order to achieve our vision, we must effectively develop, articulate and implement our strategy, and manage our performance toward that strategy. This is the foundation upon which our Integrated Planning and Assessment process is based; a key component of which is self-assessment. We must be proficient in the use of self-assessment as a tool to help us understand our strengths and areas for improvement, and use that knowledge to drive improvement in those areas important to our success. For that reason it is also important that we continually assess the progress we are making in maturing the self-assessment program. Part I of this report presents the results and analysis of progress made against key outcomes and expectations important to the Lab and DOE. Part III provides an analysis of the progress we are making in maturing our self-assessment program. This section highlights our key strengths and areas for improvement that are derived from the results of Parts I and III.

## Background

In 1995, PNNL began implementing a systematic management philosophy of simultaneous excellence – in science, laboratory operations, and corporate citizenship. Even our vision and elements of our mission changed, as we adapted our understanding of internal strengths and weaknesses based on our understanding of external factors influencing our opportunities and threats. This balanced view of performance is embodied in the Integrated Assessment (IA) Management System, and Self-Assessment is the cornerstone.

The self-assessment process is a key method by which PNNL organizations quantify performance to 1) achieve improvement in those areas important to their own and the Laboratory's success, and 2) to demonstrate effective and efficient management to ourselves, our stakeholders and our customers. A key element in the success of our self-assessment program is a strong partnership and regular interaction with DOE-RL.

In partnership with DOE-RL, PNNL sets performance outcomes, objectives, indicators, and expectations that allow us to understand progress toward strategy, our organizational health, the degree of Laboratory compliance against applicable requirements, and key improvement opportunities that are important to our continued success.

Since FY1999, we have continued to strengthen and mature the process we use to identify Lab-level issues and areas for improvement. In FY2001 we again used a team of key Level II Managers to help distill a diverse set of strengths and improvement opportunities into a core set that met one or more of the following principles:

- ♦ Poses significant risk to the Lab if not maintained or improved
- ♦ Represents significant benefit to the Lab if maintained or improved
- ♦ Can't be maintained or improved by any one organization alone.
- ♦ Supports our strategy
- ♦ Is within our power to influence
- ♦ Requires attention and periodic review by the Leadership Team.

The team used performance information taken from the following sources to support its analysis:

- ♦ External Oversight results
- ♦ Division/Directorate strengths and opportunities for improvement identified from their self-assessment activities/results
- ♦ Significant issues identified in FY2002 business plans

- ♦ Integrated Assessment management system activities encompassing self-assessment results, Independent Oversight (IO) activities, Internal Audit (IA) activities, and formal Peer Review results
- ♦ Critical Outcome results

Performance results from the above sources were consolidated and categorized, resulting in the identification of key Laboratory strengths, areas for improvement and vulnerabilities reportable to DOE. We believe that the ability to accurately identify, quantify, and act on performance data is a sign of a maturing organization that has established and maintained an adequate system of management controls to improve performance and safeguard our customers and stakeholders' best interests. It should be noted that reportable vulnerabilities are provided separately to DOE in our "Fiscal Year (FY) 2001 Management Control Program" letter. The results of our integrated analysis and categorization activities are presented below. Only those strengths and areas for improvement that warrant Lab-wide attention are presented. Although there may be additional areas that require attention, we believe such issues can be prioritized and acted upon locally (by specific issue owner), and are best addressed in applicable self-assessment plans.

## Results

### Overall Assessment

The results from our Level II teaming activity are quite remarkable and indicate that the Laboratory is entering a new phase in its ongoing evolution. Overall, the Laboratory is strong and has solid systems in place to manage performance. Performance can no longer be expressed as a generic listing of strengths versus improvements. The results that follow indicate that in all areas important to the Laboratory we have clear strengths. We are now at the point where improvement efforts are directed more toward enhancing or building upon our strengths, as opposed to fixing "broken" systems. A common theme is the need to continue to

strengthen our core processes and improve their integration to further support and enable our R&D mission work. Several illustrations highlight this point.

- ♦ In FY2001 PNNL achieved DOE Voluntary Protection Program (VPP) Gold Star status and the VPP Superior Star award. This award provides external recognition of our commitment to superior performance in health and safety with a focus on employee involvement.
- ♦ External oversight activities revealed no significant issues or instances of programmatic breakdown. In the majority of cases, our self-assessment program had previously identified issues that were highlighted.
- ♦ Our management system maturity evaluation identified our overall system, in aggregate, to be at the midpoint of the "Basically Effective" level. The evaluation states that "there are no big 'holes' in the system, but there may be some variability in the implementation of some system pieces." The evaluation goes on to point out that some of the system scores were lower for crosscutting systems, supporting the view that continuing to improve the integration of our management systems should be an area where we focus time and energy.
- ♦ Additionally, a special study commissioned by Independent Oversight (IO) and performed by a team from Washington State University (WSU) concluded that "PNNL does not have a systematic problem with procedural compliance," which further supports the view that our processes are systematically effective.

Finally, the results provided in Part I of this report clearly demonstrate that PNNL is delivering high quality and highly relevant science and technology, in a safe and effective manner that protects our people, our facilities, the public and the environment, and is having a strong community and regional impact.

## Analysis

A management philosophy of simultaneous excellence – Science and Technology excellence, Operational excellence, and a Community and Regional asset- underpins our strategy as articulated in our Lab Agenda. In FY2002, and in support of our 2010 vision, our Lab Agenda is focused around five strategic objectives: Science and Technological Excellence; Leaders in Research Management and Operations; Outstanding Managers and Staff; Deployment of Highly Beneficial Technologies, and Valued Regional and Community Asset. It therefore makes sense to consider our key strengths and areas for improvement in that context.

Figure 1 provides high level overview of the results discussed below, in the context of our Lab Agenda. These results will be considered as the Laboratory finalizes its agenda for FY2002.

It is the Lab's expectation that improvement plans/activities taken to respond to our areas for improvement will be addressed and flowed

down through appropriate organizational self-assessment plans.

## 1. Scientific and Technological Excellence

### High Quality and Relevant S&T

#### Strengths

In FY2000 we cited strategic planning, peer review, our staff and customer focus as key strengths. Those strengths remain consistent today and are the drivers for our high quality and relevant science and technology. Critical Outcome 1.0, in Part I of this report, provides exceptional evidence supporting this as a key strength.

Our strong **strategic planning** helps us understand the environment in which PNNL must operate, recognizes emerging scientific and technological (S&T) directions that will be important to our customers and stakeholders, and helps us build an

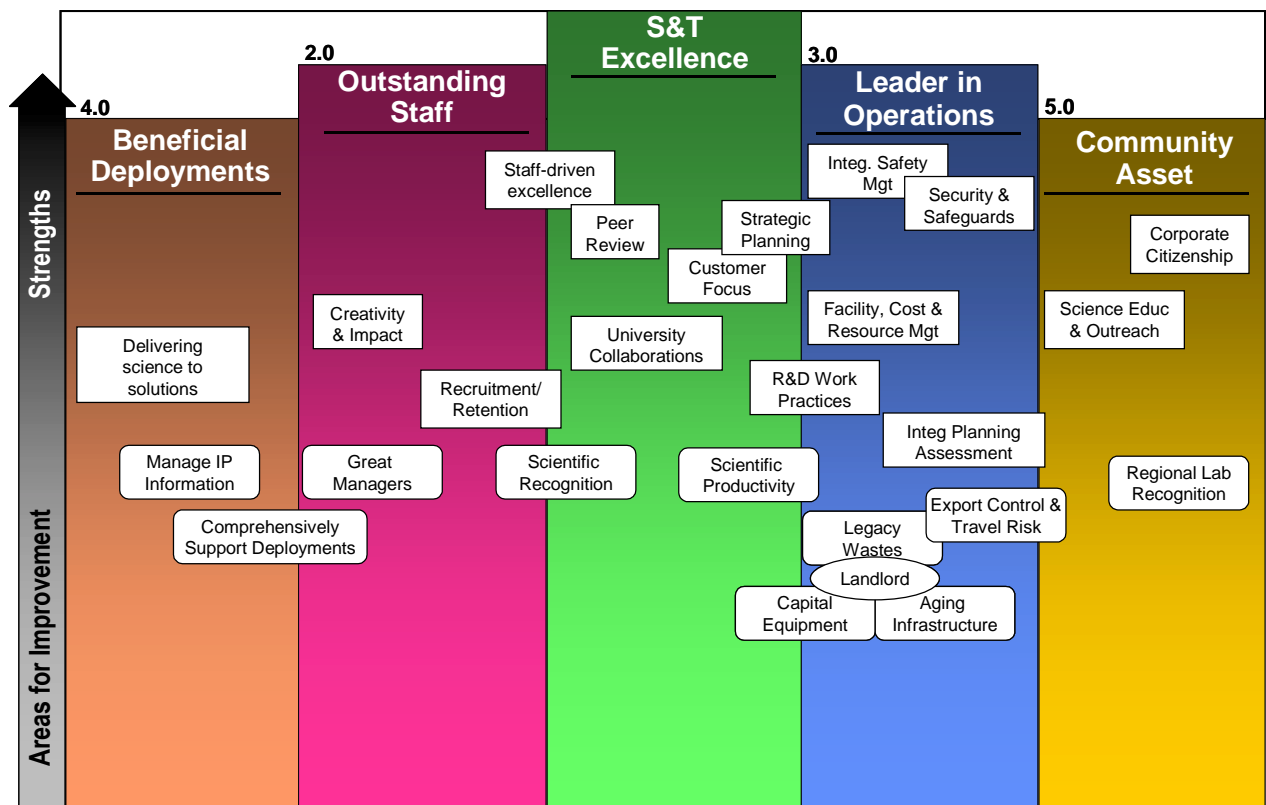


Figure 1. FY2002 Laboratory Strengths and Areas for Improvement

effective strategy to support continued success. Division Review Committee (DRC) and Laboratory Review Committee (LRC) reports continue to indicate that our strategic planning is sound. Additionally, those same reports show that strategic planning has gained strength and now permeates Division planning as well.

Our **rigorous approach to peer review** underpins our high quality S&T. The use of peer review to understand quality and relevancy with respect to Division direction and performance, LDRD investments, and new proposals helps ensure that we are focused on the most important S&T issues.

Our **strong customer focus** is also highlighted throughout Part I of this report. We see evidence of our focus in the external market through the fact that our key customers give us program leadership roles in areas that are important to them as reflected in Part I of this report. Internally, our strong customer focus is illustrated by customer survey results. Review of FY2002 business plans indicates that Laboratory organizations know their customers and work proactively to meet or exceed their customers' needs.

Our **staff continue to be the foundation driving our excellence** in science and technology. Great facilities and equipment mean little without bright and innovative scientists and engineers putting them to good use in the service of the nation. Great management system concepts have no real impact without dedicated, customer-oriented people. Part I of this report more than adequately underscores the strength of our staff. The Gallup Q-12 survey results further demonstrate staff commitment to quality. Laboratory staff gave a resounding "Yes" to the question regarding the commitment of their peers to quality. In fact, the Gallup representative stated that the percentage of affirmative responses (84%) was the highest Gallup had seen to date. This response supports numerous peer reviews that have commented on the high quality S&T that the Laboratory produces.

Finally, we add **university collaborations** to our strengths under this objective. Throughout Part I of this report (Critical Outcomes 1 and 3) we see clear evidence of how we partner with academic

institutions to promote science discovery and innovation in the service of national needs.

### Areas for Improvement

An ongoing challenge is the need to achieve **greater recognition of our scientific and technological contributions** in the community, the region and the nation. Part I of this report shows that we do have a strong local, regional and national presence but we believe that we must continue to build upon our progress. This challenge is discussed further in several other sections and leads to another area of focus in FY2002.

We believe we need to continue to **drive systematic improvements in scientific productivity**. An analysis of recognition and publication rates shows little or no increase over FY2000 levels. In fact, publication rates appear to have remained relatively stable over the last 5 years. Our analysis is provided in Part I of this report. In order to achieve our 2010 vision we must continue to drive growth in this area. We would like to have a greater scientific and mission impact for the dollars DOE invests. We recognize, however, that in order to do so we must take a hard look at how we measure productivity. In FY2002 we will focus on developing appropriate strategies to deliver higher impact and refining our **scientific productivity** measures to help us monitor progress.

## 2. Outstanding Managers and Staff

Underlying great organizations is the commitment and drive embodied in its managers and staff. In our FY2000 year-end report, we cited many reasons why our current and evolving management practices were sufficient to maintain our strength in this area as part of our on-going self-assessment activities. Today, we continue to recognize and acknowledge that we have a strong staff orientation, but we also recognize the ever-present need to keep our staff and managers at the forefront of our attention to ensure our success long into the future. It is for this reason that we have identified outstanding managers and staff as a new strategic objective in FY2002 as recognition of the place great leaders, managers and staff hold in PNNL's continued viability and sustainability.



## Strengths

The strength of our **staff** is considerable. Unquestioningly, our staff are the drivers behind our ability to continue to be a sustainable national asset. Critical Outcome 1.0 provides a summary of recognition our staff receive in the highest impact areas, focused on our science and technology. If we look across all our endeavors we find broader indications of our staff contributions. A review of the data in ERICA indicates that PNNL staff received 102 awards for their outstanding work, gave 315 presentations at professional gatherings, and provided their services to 260 organizations or committees. Lab-level awards highlighted below acknowledge the contributions our staff make to the lab, regardless of discipline.

- ◆ DOE VPP Gold Start Status and Superior Star Award,
- ◆ Federal Energy Management Program Award for Energy Savings,
- ◆ White House “Closing the Circle Award”,
- ◆ EPA “Waste Wise Champion”, and
- ◆ DOE Pollution Prevention Awards

We noted, via the Gallup survey, that our staff value each other and each individual’s commitment to quality.

We also recognize that there are examples of **great managers**. The Gallup survey conducted in FY2001 indicates that we have some truly great managers, representing the best in class in what they do. They provide materials and equipment necessary to do an effective job, take personal interest in staff well-being, and provide opportunities at work for staff to grow and develop.

PNNL’s People vision is to be known as the science and technology benchmark for managers who are talented at enabling staff to pursue individual and organizational goals with distinction. The **Management Skills Development Program** is part of this overall strategy for strengthening management capabilities.

Finally, we must recognize the manner in which **PNNL fosters creativity and impact** through encouragement in areas such as:

- ◆ Peer to peer communication through the support of publications, presentations, attendance and participation at conferences, and the writing of books.
- ◆ University collaborations
- ◆ Science education
- ◆ Diverse technical capabilities
- ◆ Participation as a recognized “player” in emerging national issues (e.g., energy, counter-terrorism).

## Areas for Improvement

Although we have made systematic progress we recognize that there are several key areas in which we need to maintain focus. We must *recognize, reward and retain* exceptional staff. We need to continue to improve the **recruiting process** such that we create a pipeline for top talent to funnel into. Essentially, we need a more systematic process to help us consistently hire the top 10%. Finally, as discussed under previous objectives we need to **continue to enhance our recognition/reputation** (Nationally) in key areas (science, government, etc). Past and current peer review results all indicate that if we are known for cutting edge S&T, then great scientists and engineers will come to work at PNNL. This means that our S&T agenda, coupled with competitive benefits packages and salaries will promote our continued attractiveness in the employment market.

## 3. Leaders in Research Management and Operations

In FY2000 we identified resource management, information protection, integrated safety management flow-down, cost management, integrated assessment, PAAA, and travel risk mitigation as key areas for improvement. Although the way we think about these issues has changed since last year, all are addressed in the following sections.

When we think about what it means to be leaders in research management and operations two key areas emerge as critical to our long-term success: 1) New equipment and facilities and revitalization of our existing ones is essential to support the ongoing and emerging S&T missions of the

Laboratory, and 2) the need to continue to enhance our processes and tools such that they engender exceptional R&D work practices. In the latter area we can divide our processes into those that are business oriented and those that are focused on R&D work processes.

## Equipment and Facilities: New and Upgrades

### Strengths

PNNL operates more than 2 million square feet of facilities. Half of this space is in buildings that were built and are maintained by Battelle. Among the unique facilities operated by PNNL for DOE are the premier scientific user facility, the William R. Wiley Environmental Molecular Sciences Laboratory (EMSL), and the Radiochemical Processing Laboratory. Other examples of our unique facilities and specialized equipment include the G-1 research aircraft, a wind tunnel, and the Marine Sciences Laboratory in Sequim, Washington. In FY2001 we completed the User Housing Facility, which provides low-cost, nearby accommodations for visiting scientists and students collaborating with PNNL scientists and utilizing facilities such as EMSL. This project was completed using third-party funding. Over the past 10 years, four new buildings, totaling more than 310,000 square feet of laboratory and office space, were constructed on the PNNL campus using innovative third party financing. This **innovative approach to financing** as well as **Battelle's willingness to invest and accept risk** (i.e., Battelle guarantees leases) in the Laboratory for the future are considered key strengths and are critical to PNNL's long-term viability.

We have an increasingly comprehensive facilities strategic plan. In FY2001 we developed concepts for integrating sustainable technologies into PNNL's new Vision 2010. Sustainable concepts were identified and evaluated which could be used to develop a master site plan, as well as individual facility designs. The results of this effort will be discussed with the PNNL Leadership Team and DOE-RL to determine how a sustainable campus design might be used to deliver on the Laboratory's strategic objectives, for current and future missions.

Our approach to facility management demonstrates how to **achieve cost savings in an environmentally friendly manner**. Our implementation of no-cost/low-cost energy saving strategies allowed us to avoid over \$200K in energy-related costs, earning PNNL a 2001 Federal Energy Management Program (FEMP) award for energy savings. We also gathered baseline water use information to accurately track our water reduction efforts for the campus grounds. This effort led to a reduction in irrigation water usage in PNNL owned facilities by nearly 35% with some areas approaching 70% reductions. Our efforts have been shared with local building owners, other National laboratories, and highlighted at this years' National Pollution Prevention Conference in New Mexico.

We also established a secure Limited Access Island in EESB, and leased an existing office building. These activities, again funded through a Lab-level OII, directly supports our National Security mission area.

### Areas for Improvement

Although we have clear strengths in our approach to managing our equipment and facilities there are areas that need continued focus, as reported in our "Fiscal Year (FY) 2001 Management Control Program" letter. We have two issues related to **legacy waste** funding that impact aggressive retirement of surplus facilities. An additional issue reported is the **lack of adequate "landlord" capital funding** for the Radiochemical Processing Laboratory. Details on these issues are provided in the letter referenced above and will not be reiterated here. However, both issues require funding to bring them to full closure.

In order to maintain and attract innovative scientists and engineers, there continues to be the need for **capital equipment**, which includes new equipment as well as upgrades to existing equipment. This is perhaps more of a challenge as these improvements too, hinge on funding. Focus on finding new resources for capital equipment renewal will be on-going.

Our **aging infrastructure** was a consistent theme across the majority of business plans. Our challenge here is twofold. First, we must maintain our current infrastructure in an operational state. Second, we must develop a creative financing portfolio to respond to our new program initiatives that support our 2010 Vision. Achieving the 2010 Vision will result in the addition of 1 million square feet of new space with 5 new facilities supporting our R&D missions. In addition to the aging of our facilities infrastructure, areas of concern include establishing full cost recovery for the new User Housing Facility, and managing the limited office space required for our research staff.

### Exceptional R&D Business Systems

In our FY2000 report we identified Resource Management, Cost Management, and Integrated Assessment as separate areas that needed continued management attention. As we consider these areas in more detail we find that they are really part of a larger system, that of Integrated Planning and Assessment.

A key theme that we find in business plans for FY2002 is the need to continue to improve the integration of our systems, processes and associated tools in an effort to increase productivity and improve cost-efficiency. From a business perspective, Integrated Planning and Assessment should help drive that integration.

### Strengths

Our **strategic planning** process has been recognized externally as a clear strength. This was discussed previously and won't be reiterated here. However, it is important to note that our strategy is supported and implemented throughout the Laboratory through the integrated planning and assessment process. There are many aspects of our **planning and assessment** system that are clear strengths. Our Lab Agenda now reflects better integration of elements of the Performance Evaluation and Fee Agreement (i.e., Critical Outcomes) with other aspects of the Laboratory's change agenda. Use of self-assessment results to help

establish Division and Directorate objectives and expectations in business plans has resulted in better alignment of assessment to important business outcomes.

The interactive Lab Agenda, implemented in FY2001, allows authorized staff to enter progress reports directly on the agenda, providing Laboratory-level performance information to staff across the Laboratory. Progress against Lab-level OIIs is also accessible to staff. We have implemented a Performance Data portal, another technology that is designed to connect staff across the Laboratory to performance information from a variety of sources. The performance information cited above is accessible to all staff via the Strategic Planning Homepage. Our Integrated Planning and Assessment approach has served to reduce several redundant calls for data updates and has provided greater consistency in the collection and communication of performance-related information. In FY2001 we were asked to share our process with several National Laboratories as well as at several conferences. An important strength of this Laboratory is our emphasis on driving strategy down through all our divisions and directorates in a systematic manner. Our efforts in FY2001 centered around resource management, cost management and integrated assessment highlight additional strengths.

A systems approach to **resource management** was highlighted in our FY1999 year-end report and carried forward as an area of focus into FY2001. In previous reports we stated, "Resources include facilities, space, the infrastructure, equipment and staff. All planning and management decisions should be made treating all components as part of an overall resource system. For example, buildings and the computing infrastructure are both components of our resource base. Decisions on the financial support to these components were generally made on an individual basis. The lack of a systems approach can lead to sub-optimization." Resource management is integrated with strategic planning and is addressed through the Integrated Planning and Assessment process. Over the past year, this

integration and a comprehensive approach to decision making has become more evident in Laboratory management's approach to strategic planning.

We have made solid progress through FY2001. We have strategic plans in place for both Facility and Operations, and Information Technology (IT). We have implemented an IT Breakthrough team and our Technical Network strategies are in place. In the context of our initiatives we have accomplished the following: 1) Our Computational Science and Engineering strategy is now tied to our IT strategy, 2) Our Biomolecular Network Initiative strategy is tied to hiring, and the acquisition of laboratory and equipment resources, and 3) Our Nanoscience and Technology strategy is tied to DOE-SC expansion.

Finally, as reported in Part I (Critical Outcome Indicator 2.2) of this report, we believe we made outstanding progress. We believe we have the right elements in place and that we must now concentrate on managing the maturation of the process.

Cost management was an area identified as needing improvement in our FY2000 report. In fact, we believe that the application of rigorous **cost management** techniques has allowed PNNL to continuously increase value delivered to its customers. We have adopted a standard set of measures and metrics that are used routinely to monitor financial performance, and we have a pricing strategy that drives resource availability. We also conduct benchmarking activities to help us identify potential system enhancements.

Results identified in Part I (Critical Outcome indicator 2.1.2) show that we are effectively managing costs. Our approach to cost management recognizes that the scientific revenue base of the Laboratory must grow. Our approach however, also recognizes the need to continually improve the effectiveness and efficiency of our core processes. In the draft "Pacific Northwest National Laboratory Institutional Plan, FY 2002-2006" we highlighted cost efficiencies gained in a number of areas including SBMS, Safeguards and Security, and Facility and Operations. Our OII summary, provided in Appendix B, also describes the cost reductions

(or avoidance) expected as result of our Lab-level improvement investments. An important point to note is that the identification of cost savings or avoidance, through improvements in the effectiveness and efficiency of services provided is built into our OII process.

The need to continue to strengthen the Integrated Assessment program was mentioned in several portions of the FY2000 DOE year-end report. The key themes mentioned were integrating assessment plans and results at the Laboratory level, strengthening the connection of self-assessments to the Laboratory strategy, continuing to increase deployment, and further strengthening corrective actions. In fact, there are also some key strengths in the **integrated assessment** process, most notably with respect to self-assessment. In the area of performance measurement there are numerous examples of how the Laboratory tracks and/or trends performance results including:

- ♦ Science and technology recognition measures such as publication growth (as well as where we are publishing), awards, invited talks and committee service,
- ♦ proposals won versus submitted in several key DOE-SC areas,
- ♦ key measures within each of our strategic initiatives
- ♦ key environment, safety and health statistics, as well as trending event reporting and radiological problem report results,
- ♦ standard financial measures and metrics,
- ♦ safeguard and security incident rates,
- ♦ strategic hires, voluntary separation rates, and quality of worklife results, and
- ♦ new business spin-offs, and assistance to local and regional firms.

Many of these results are presented in Part I of this report and indicate that PNNL is operating at the outstanding performance level. A review of external oversight results indicates that no significant issues were identified that we had not previously identified internally, and that we were actively managing, further supports the strength of integrated



assessment at PNNL. Additionally, a recent study conducted by researchers from WSU, at our request, indicates that

“discussions with the research and facility operations managers indicated that the Laboratory is doing a good job of capturing leading indicators. There was an extremely strong sense of ownership of compliance amongst the research operations and F&O managers. They view themselves as having the ultimate responsibility for compliance and take appropriate pride in their efforts to continuously monitor and improve compliance”.

The point is that self-assessment is not just about what is written down on paper; it is about what we plan and how we interact on a day-to-day basis. A strong self-assessment program must be supported by facts and data coupled with regular interactions between staff and managers. This is how a continuous improvement culture is created.

### Areas for Improvement

While we have come to understand that we have clear strengths in our approach to managing our business, we also recognize the need to continue to improve our processes to deliver more value to the Laboratory, our customers, and stakeholders.

Overall, in the area of **integrated planning and assessment** we must continue to focus on streamlining the process. Although we have reduced redundancies in certain areas more progress is needed. Our attention will be directed toward improving how information from business plans, OIIs, and the Lab Agenda (including critical outcomes) can be better integrated and communicated. We also need to complete a consolidated subject area that helps line managers understand and implement the planning and assessment process.

In the area of *resource management* we need to manage the maturation of plans and approaches we have put in place.

In the area of *cost management* our greatest challenge will be to continue to work to resolve

**stewardship** issues in areas such as EMSL and EM funding for facility operation, maintenance, and renewal. Overall, we believe our approach to cost management is sound and that we need to let it stay its course.

Several areas will require attention in FY2002 with respect to *integrated assessment*. *Tracking and trending* Lab-wide will continue to require attention. Coupled with this need is a desire to re-evaluate our **scientific productivity** measures and determine if one common set of performance measures at the Lab-level are appropriate to our business. Information from the procedural compliance study conducted by researchers at WSU, as well as results from our analysis of Facility Representative surveillances indicates that more attention is needed to assure that the Laboratory and DOE-RL have a *common understanding of performance expectations* in order to achieve an effective and efficient assessment and oversight balance. Finally, a key area for improvement continues to be our *corrective action management (CAMS)* process. Through FY2001 PNNL outlined the process, determined new system design needs, and has established needed changes to our Assessment Tracking System (ATS). Furthermore, we have identified a recommended approach to determining “significance” and to performing causal analysis. The challenge will be to describe the system in SBMS, upgrade ATS and fully implement the CAMS process at the Laboratory in early FY2002.

With respect to self-assessment, we need to place renewed emphasis on *activity-based assessments* to assure ourselves that appropriate operational discipline is being maintained. Indications also support the need to better integrate external oversight issues into future assessment planning.

One area that has emerged from our FY2001 OII effort entitled, “Drawing the Roadmap to Second Generation Management Systems” is the recognition that we don’t have adequate understanding of how our *processes enable R&D work practices*. We will need to place emphasis in this area in FY2002.



## Exceptional R&D Work Practices: Work Processes

In the FY2000 report we identified ISM flow-down, PAAA, Information Protection, and Travel Risk Mitigation as separate areas that needed continued management attention. As we have considered these areas in more depth, we find that they are really part of a larger whole that can be better organized around Integrated Safety Management, Integrated Safeguards and Security, and management system performance.

### Strengths

Achieving DOE Voluntary Protection Program (VPP) Gold Star status and the VPP Superior Star award provide clear evidence of the strength of our **Integrated Safety Management** System and its flow down to the bench. Our performance, as described in Part I (Critical Outcome objective 2.1) provides further evidence of a culture that recognizes the importance of performing work in a manner that promotes excellence in environment, safety and health performance. The special study on procedural compliance also acknowledged a culture where compliance is taken seriously and is owned by the line. Finally, the fact that the Laboratory continues to make investments, through Lab-level OIIs, in areas such as hazard analysis, electrical safety, replacement of ACES, the institutionalization of IOPS, and in EJTA/IOPS/SDTP improvement and integration indicates that all levels of our organization recognize and value principles of ISM and are working hard to assure that it is a part of how we do business.

In the area of *Hazard analysis*, specifically cited in our FY2000 report, we have seen solid progress. The Integrated Operations System (IOPS) main page was modified to enhance accessibility through a role-based menu. This was a joint effort between researchers, line management, and the IOPS staff. In addition to role-based enhancements to IOPS, the IOPS subject area now defines responsibilities for hazard analysis and communication. Other enhancements to the IOPS tool have further strengthened this capability. The Hazard Analysis initiative is a 3-year project designed to make improvements in the identification, evaluation, and

mitigation of environment, safety, and health hazards. The project integrates and improves existing tools like the Electronic Prep and Risk (EPR), SBMS, and IOPS to enhance the role based efficiency and effectiveness of research and development work planning and control. When complete, this tool can be expanded to address other issues relevant to research and development operations including security, quality, and property management. The project also anticipates the ability to deliver cost savings in terms of reduced labor for research and development work planning and fewer accidents and incidents. OII funding for both the IOPS and HAI initiatives will continue through FY2003.

PNNL has continued to strengthen the *Price-Anderson Amendments Act (PAAA)* Compliance Assurance Program and enhance its nuclear safety rule compliance. Through the assessment activities cited in FY2000, and actions taken in FY2001 PNNL has determined that the PAAA Compliance Assurance Program is sound, includes appropriate guidance for managers and staff through the Standards-Based Management System, and is effective at managing follow-up of self-disclosing events. The fact that we have a sound program was acknowledged by EH-10 during a recent meeting at PNNL. More detail can be found in our, "Fiscal Year (FY) 2001 Management Control Program" letter, dated August 28, 2001.

Our **Integrated Safeguards and Security** program represents another strength. Although safeguards and security is a highly complex system, with numerous requirements that must be effectively managed, results from Part I (Critical Outcome indicator 2.1.3) indicate a well managed system and a Laboratory culture that acknowledges the importance of effectively managing and protecting our sensitive assets. External reviews (also presented in Part I) provide further evidence of the strength of this system.

### Areas for Improvement

In FY2002 we will continue to focus improvement efforts on implementing *integrated safety management* at the bench. The majority of our FY2001 OII funded activities will continue in FY2002

(IOPS and Hazard Analysis). As previously identified under self-assessment, *activity based assessments* will have renewed emphasis.

A working group was formed in May 2001 to identify opportunities for improving the processes and procedures for *managing radioactive material* at PNNL. The scope of the working group includes identifying all relevant requirements, analyzing the requirements to determine the best approach to simplify delivery to the users and determining the judgments of need, that when implemented, would improve performance in radioactive material management. The working group went on to define the problem and identified judgments of need that if addressed will improve radioactive material management at the Lab. A Laboratory operational improvement initiative was funded to address the judgments of need developed by the working group. This operational improvement initiative will be a coordinated effort between the Facility Safety, Facility Operations and Maintenance, Environmental Management Services, Radiological Control, and Safeguards and Security management systems in concert with line management. Completion of the activities will result in a more streamlined process that integrates across multiple management system requirements. It will also eliminate duplication of effort by staff in trying to implement various management system requirements and standardize the method staff use for maintaining radioactive material inventories.

We will continue to place emphasis on strengthening staff awareness and understanding of *PAAA* and tracking and trending PAAA results in FY2002.

In FY2002 safeguards and security will place attention on information protection related to **export control** and *computer backup and recovery* (backup and recovery also applies to IT). We will also place continued emphasis on **travel risk mitigation**. A recent Internal Audit report identified weaknesses in the Laboratory's Export Control program and actions are underway to improve compliance with applicable requirements. This area was included in our FY2001 Management Control Program letter

to DOE. An Internal Audit of PNNL's Backup and Recovery process considered the process to be generally adequate but noted a number of systems that did not have adequate backup, and that some staff were not familiar with, or chose not to use the Lab-wide WB&R server. Although we have made improvements in the area of travel risk mitigation we believe that continued attention is required. An Internal Audit determined that the majority of controls in place to support International Activities (Travel) are adequate. However, some areas of concern were identified where security and control could be strengthened in the areas of guidance and education. In addition, the tragic events of September 11<sup>th</sup> require us to think about this area differently. More emphasis in FY2002 will be placed on domestic travel risk mitigation needs.

Improvement will continue in selected *Management Systems* based upon the results of the Maturity evaluation. Recommendations are provided in the OII summary provided in Appendix B.

#### 4. Highly Beneficial Deployments

Battelle has long recognized the importance of transforming ideas to application. The very nature of our key missions, as expressed in Part I of this report (Critical Outcome 1.0), are focused on the creation of new knowledge that is ultimately transformed into applications that benefit the nation and humanity. This principle is at the core of what Battelle stands for and quite possibly is the best reflection of why Battelle is so well suited to managing a National Laboratory like PNNL.

Technology deployment encompasses both technology developed and deployed to meet critical DOE missions and technology deployed to the commercial sector through both government and contract or funded technology transfer programs.

##### Strengths

Whether we look at community, regional, national or international impact, our focus on **delivering science to solutions** is a clear strength. On the one hand, we acknowledge that the pursuit of new ideas that further the discovery endeavor are vital and necessary. On the other hand, we also recog-

nize that the public expects us to deliver results for every dollar invested. Evidence of our commitment to both endeavors is obvious throughout our LRC report. Although there is a delicate and sometimes precarious balance, we choose to act upon that challenge and actively manage it.

Part I, Critical Outcome 1.0 and Critical Outcome Objectives 3.1 highlight key accomplishments in delivering science to solutions through technology deployment and assistance to local and regional firms. Those results won't be reiterated here. In the area of technology commercialization we have delivered outstanding results, exceeding our performance expectations in the creation and protection of intellectual property, operational effectiveness, and the creation of significant value through collaboration agreements and licensing transactions, including the creation of new ventures field by PNNL-derived IP.

### Areas for Improvement

Although we are strong in our focus on delivering highly beneficial deployments there are significant areas for improvement that warrant our attention in FY2002 and beyond.

The loss of staff and/or capabilities due to deployments is an area warranting attention. We need to provide more **comprehensive support to deployment**. We need to focus on succession and capability planning before staff leave our organization. Coupled with this need is the desire to provide our deploying staff with a greater potential for long-term success. We believe we can provide staff with more education, mentoring, or partnering opportunities that would better prepare them for success in the commercial markets.

We also need to focus on guidance and communication that demonstrates that the activities of technology commercialization and advancing scientific frontiers can be achieved simultaneously. As a research organization, *protecting intellectual property*

must work hand-in-hand with processes that enable publication and sharing of scientific information. We will continue to protect intellectual property through means such as patents and copyrights. At the same time, we must enhance how we **manage IP information** to enable research results to continue to be published and information to be shared with the scientific community as well as the public.

## 5. Valued Regional and Community Asset

Battelle has long held a reputation of caring and giving in the communities and regions in which it operates. This objective denotes one of the hallmark principles Gordon Battelle left as a legacy to the communities and regions in which Battelle operates. This legacy continues today.

### Strengths

PNNL continues to demonstrate strength through the very positive image and reputation it holds in the Tri-Cities and beyond. We are acknowledged as a **strong corporate citizen**. We are also well recognized for the depth and breadth of the university collaborations we foster, and our **science education and outreach program** continues to receive strong recognition for its contributions to both teachers and students.

### Areas for Improvement

We must continue to establish a great reputation in key areas, such as science and government, in the regional and national arena. At the same time, we need to enhance the **regional recognition** of the Laboratory and what we do. There is a need to share our S&T results more effectively within the community and region in which we operate. Clearly, the Battelle name is known, however, people have a hard time articulating just what it is that we do that contributes to the community and region. We have made strides in communicating our accomplishments but more is needed.



## **Part III**

### **Assessment of PNNL Self-Assessment Program Maturity**

# Assessment of PNNL Self-Assessment Program Maturity

## Overview

Pacific Northwest National Laboratory's (PNNL) vision is to be among the world's premier scientific institutions and research laboratories, conducting research at the interfaces of the physical, life, and information sciences and technology; known for solving the U.S. Department of Energy's (DOE) most critical and challenging problems, widely recognized for operational excellence, and highly valued by the community and region in which it operates. In order to achieve our vision, we recognize that we must effectively articulate our strategy and manage our performance toward that strategy. This is the foundation upon which our Integrated Planning and Assessment programs are based. A key component of Integrated Planning and Assessment is self-assessment. To achieve our vision, we must be proficient in the use of self-assessment to drive continuous improvement in areas important to our continued success. For that reason it is important that we continually assess the progress we are making in maturing the self-assessment program.

## Background

In the years leading up to FY1999, we focused primarily on evaluating the degree to which each Division and Directorate implemented a self-assessment process. Evaluations were done using internal subject matter experts. This approach made sense because we were trying to drive an assessment discipline into the Divisions and Directorates that did not exist previously. In essence, we focused on ensuring the self-assessment program had depth and breadth. The key performance objectives that united the Laboratory were the Laboratory-level Critical Outcomes.

In FY1999, we shifted to an evaluation of how well the Divisions and Directorates used assessment results to drive business decisions, in addition to understanding how effective their self-assessment processes were. This evaluation was done using

internal subject matter experts with assistance from two external experts. Again, this approach made sense as we were attempting to understand how broadly self-assessment was used, understood, and acted upon to drive further improvement. At this same time, the Laboratory Agenda was more clearly articulated, and Divisions and Directorates were beginning to more systematically align their annual performance objectives to it.

This evolutionary process continued in FY2000. The Laboratory recognized that it was time to forge the connection between planning and assessment. This was accomplished by incorporating organizational assessment results, performance objectives, indicators and expectations, into the business plans. Our expectations were that we would strengthen the link between what we plan and what we do; that this change would allow us to better analyze and share results across the Laboratory; and that this change would not be easy and would require us to improve the process in FY2001 and beyond. An analysis of results indicates that we achieved our expectations for this pilot year, and set the stage — not only for an evaluation of continued self-assessment program maturity in FY2001 — but for an evaluation of all the Laboratory's management systems. The results of our on-going efforts are described herein.

## The Process Underlying Self-Assessment

In partnership with DOE, PNNL sets performance outcomes, objectives, indicators and expectations that allow us to understand: progress toward strategy; our organizational health; the degree of compliance against applicable requirements that exists across the Laboratory; and key improvement opportunities that are important to our continued success. Our approach to assessment is in direct alignment with the requirements of DOE Order 224.1 Performance-Based Business Management Oversight Process, and is discussed below.



Critical outcomes and associated objectives, indicators and expectations are documented annually in Battelle's Performance Evaluation and Fee Agreement with DOE. The Critical Outcomes are incorporated into the Lab Agenda, which is then translated into appropriate business plans and associated self-assessment plans across the Laboratory. The results of FY2001 self-assessment activities are addressed in the Laboratory's FY2002 business planning template. Areas of strength and weakness are addressed in the Level 1 Manager and Management System Owner business plans. Objectives are developed to improve overall performance. The integration of self-assessment with business planning has helped demonstrate that a comprehensive self-assessment program is providing managers with compliance performance information, program effectiveness, and customer satisfaction feedback. This information and the actions identified in the business plans support the Laboratory's continued improvement.

A key facet of our Performance Evaluation and Fee Agreement is our partnership with DOE-RL through every phase of its development including self-assessment plan development that occurs at the Division and Directorate level, and at the Management System level as well. In certain areas, such as BMOP, additional RL interfaces exist and are actively managed.

Measures directed specifically toward understanding the degree of **compliance with applicable DOE and Federal requirements** are incorporated into organizational self-assessment plans, as applicable to the work performed. Applicable requirements are identified through the requirements integration and tailoring process managed by the Requirements Management function of the Standards Based Management System (SBMS). Through Requirements Management, new or revised external requirements are assigned to appropriate management system owners who then use the Record of Decision (ROD) process to determine whether requirements are applicable, and if so, how the requirement is being, or needs to be addressed. To date, 83% of all requirements passed down through our contract have RODs in place. Requirements that can't be immediately dispositioned are tracked through the Assessment

Tracking System (ATS). We manage our self-assessment process through a strong partnership with DOE, specifically through the assignment of DOE counterparts to Management Systems and Level 1s.

Responsible Management System Owners (MSOs) deploy applicable requirements to the bench through subject areas via SBMS or other communication mechanisms (such as B manuals) as appropriate. In some cases, tools such as the Electronic Prep and Risk (EPR) and the Integrated Operations System (IOPS), are modified or enhanced to assist staff in the correct implementation of requirements. The actual degree of compliance that exists with respect to applicable requirements and key internal controls is measured through self-assessment coupled with regular operational awareness. The responsibility for compliance is shared both by MSOs and the line organizations to which implementation is applicable.

Each year organizations (MSOs and the Line) evaluate past/current performance, determine the **degree to which key requirements and internal controls have been met, including identification of strengths and areas for improvement, prioritize improvement opportunities, and develop self-assessment plans to assess progress.** Significant issues that impact progress are included in appropriate business plans for the upcoming year. MSOs may monitor compliance with requirements through evaluation of existing trends (e.g., worker health and safety statistics, and Event Reporting, Quality Problem, and Radiological Problem Report trends) coupled with statistics associated with tools they have developed (e.g., Use statistics). Significant issues that warrant attention are included in applicable business plans. This self-assessment process is accomplished in partnership with DOE-AMT representatives; it may also include other DOE SMEs as applicable to the specific area of interest.

Division and Directorate Line Management are ultimately accountable for deployment of requirements at the bench. An understanding of compliance to requirements is derived in a number of ways. As illustration: ETD evaluated the requirements applicable to the Division and determined a "rank importance" for each requirement. ETD

then determined whether or not existing self-assessment activities addressed each area and whether the assessments were formally planned or opportunistic. This approach was adapted by FSD for its use. F&O has a similar approach. However, F&O has adopted a more rigorous “significance” determination into its process. Operations Managers meet monthly to discuss common issues regarding performance and identify actions that will be taken, as appropriate. DOE Facility Representatives are invited to these forums. A key challenge for the future is to share these best practices and implement them across the laboratory.

Internal Audit, Independent Oversight (including review of external oversight activities), and PAAA oversight provide a check and balance to our understanding of compliance across the Laboratory. Results from these oversight activities are evaluated for systematic trends. Finally, field-deployed internal SMEs and DOE Facility Representatives provide supplemental information regarding compliance through their daily oversight activities.

The performance results derived from the process described above are consolidated and categorized, and are used to identify key Laboratory strengths, areas for improvement, and vulnerabilities reportable to DOE. The ability to accurately pinpoint key strengths, areas for improvement, and reportable vulnerabilities is a sign of a healthy and maturing organization that is capable of establishing and maintaining an adequate system of management controls, and continuously improving and renewing itself to assure that appropriate management control is maintained. Since FY1999, we have continued to strengthen the process we use to identify Lab-level issues. Reportable vulnerabilities are provided separately to DOE in the “Fiscal Year (FY) 2001 Management Control Program” letter. Key Lab-level strengths and areas for improvement are presented in Part II of this report. Overall program maturity is presented herein.

## Results

### Overall Assessment

The results provided below, in addition to those detailed in Parts I and II of this report, indicate that our self-assessment program continues to mature.

We are delivering important and impactful results to our customers and stakeholders, we are staying true to our simultaneous excellence management philosophy, we are making progress toward our strategy, and using assessment to help us understand performance. In addition, we are not finding systemic process issues. Rather, we are finding that we need to continue to enhance our current processes and improve their integration.

## Analysis

**Management Systems Maturity Evaluation:** A maturity evaluation process focused around management systems was piloted at PNNL in FY2001. The intent of this pilot effort was to establish a platform that would allow us to understand the effectiveness of PNNL’s management system concept for operating a Laboratory, and to identify individual improvement opportunities for individual systems as well as overall management system constructs. The evaluation was conducted using a set of questions based on the Baldrige National Quality Program Criteria for Performance Excellence, which covers all key aspects of performance. The questions were designed to identify the level of sophistication with which management system owners operate their systems. A set of Baldrige-based scoring criteria was applied to the responses, and a maturity rating was assigned to each management system. The rating is an indicator of the extent to which the management system has the ability to systematically be what it needs to be in order to be successful and can demonstrate its progress in getting there. An overall evaluation of results can be found in our FY2001 OII summary in Appendix B.

The results of the maturity evaluation indicate that, taken as a whole, PNNL’s management systems have achieved an overall maturity rating of 3.6 on a 6-point scale, which translates to the mid-point of “Basically Effective.”

*Some of the key positive (+) components of this evaluation are:*

(+) Most management system owners (MSOs) have done a good job of defining their system and the processes used, and have identified the key functions and linkages to their most important products and services.

(+) MSO and staff responsibilities as outlined in PNNL's Roles, Responsibilities, Accountabilities and Authorities (R2A2s) are generally well executed.

(+) Some systems are beginning to establish and manage to system-developed performance targets; and in some cases, benchmark studies and exchange of comparative data are underway.

*Some of the negative (-) components of this rating are:*

(-) In some cases, documentation that demonstrates implementation of external requirements (e.g., Records of Decision), or that describes internal operating procedures, is inadequate.

(-) In some cases, external drivers influence performance measures at the expense of adequately measuring the effectiveness and efficiency of the management system's internal processes.

(-) In a few cases, there is still some confusion as to who the customer is. Systems that receive direct funding or that operate in highly regulated areas appear to have the greatest issue with clarity regarding customer identification.

*Path Forward:* By developing and applying a common framework to determine the maturity of each management system, we can assess the overall management and maturity of our entire management system. By comparing the current level of maturity of each management system with an "ideal" maturity paradigm, we can begin to make decisions regarding investments in improvement initiatives. Thus, we will be able to achieve an optimal balance between the effectiveness of our management systems and the expenditure of resources in the future. In FY2002, planned follow-on activities include:

- ♦ Establish the expectation that Management System Owners gather sufficient information on line/end user implementation of a self-assessment process that enables a credible evaluation of the effectiveness of system processes and the corresponding level of risk the Laboratory may be incurring as a result of process deficiencies.
- ♦ Investigate the feasibility of developing an "integrator" management system that will provide a better fit for systems that are crosscutting (e.g., Integrated ES&H and Quality).
- ♦ Collect feedback on the value of the maturity evaluation and the clarity of the questions used. Review FY2002 MSO business plans for inclusion of maturity evaluation results. Update the maturity evaluation questionnaire and modify the maturity evaluation process, as appropriate.
- ♦ Post summarized maturity evaluation results and ratings.
- ♦ Integrate the maturity evaluation with the Management System peer review process (i.e., Deep Dives) and business planning process.
- ♦ Establish maturity targets for a subset of less mature management systems based on input from management system customers (R&D representatives) and owners.
- ♦ Develop performance indicators for management system maturity that can be used to demonstrate progress towards established targets.
- ♦ Continue maturity evaluations for all management systems. Provide assistance and scoring to ensure continued consistency.

**Internal Audit:** Internal Audit (IA) conducted over 15 audits in FY2001. In the majority of cases adequate systems of control were found to be in place. Three audits identified areas that warrant more attention: Export Control, Computer Backup and Recovery, and Travel. In the area of Export Control IA noted that the controls in place were somewhat weak and noted areas where the controls could be strengthened. Issues cited included the lack of centralized information and no clear program owner, air express shipments to sensitive countries not going through the correct clearance review process, and project planning guidelines not addressing export control. The Backup and Recovery process was considered generally adequate but noted a number of systems that did not have adequate backup, and that some staff were not familiar with, or chose not to use the Lab-wide WB&R server. It was determined that

the majority of controls in place to support International Activities (Travel) are adequate. However, some areas of concern were identified where security and control could be strengthened. These areas are included in Part II of this report.

An internal audit investigation of a staff member's concerns regarding commercialization of PNNL's micro technology intellectual property identified several concerns. The investigation substantiated those concerns and determined interference did occur between Battelle's commercialization's efforts and DOE's micro technology work with the Office of Transportation Technologies. As a result of Internal Audits work, the PNNL commercialization process was substantially strengthened in the areas of interference, conflict of interest and fairness of opportunity. Internal Audit will perform two follow-up reviews of intellectual property during FY2002.

#### **Independent Oversight (IO) Special Studies:**

IO reviewed the Environmental Management System (EMS), the Radiological Airborne Emissions Monitoring (RAEM) and Integrated Safeguards and Security Management (ISSM) programs, trends in Facility Representative (FACREP) surveillances, controls for biological select agents, the 305-B storage unit and 325 Hazardous Waste Treatment Units (HWTUs), the EMS against the ISO 14001 standard, and Laboratory procedural compliance by Washington State University. Results from the studies generally showed the following strengths:

- ♦ A high degree of customer satisfaction
- ♦ Managers and staff attuned to fundamental concepts of operations and quality assurance
- ♦ Effective, compliant operations and fundamentally sound work practices and clear roles and responsibilities.

Additionally, Washington State University concluded in its study that there was no systematic procedural compliance issue at PNNL.

The following opportunities for improvement were identified. The FACREP study showed that there needs to be increased understanding among

the Laboratory, AMT, and OPE with respect to the philosophy of oversight, performance expectations, performance terminology, and operational risk. AMT and OPE have recently begun a process to resolve these differences. Laboratory management must continue to emphasize the importance of reaching a common understanding to communicate effectively across organization boundaries and create the synergy to achieve mutual PNNL and DOE-RL goals. This area is included in Part II of this report.

The biological controls study showed that the processes to identify requirements did not capture some Code of Federal Regulations requirements, and self-assessments had not previously reviewed biological controls. The HWTU study showed that improvements could be made in safety, procedure configuration control, and feedback and continuous improvement. The ISO 14001 study showed that there were some noncompliances with the ISO 14001 standard, but they could relatively easily be resolved.

**Analysis of Business Plans:** Our analysis of business plans continues, with a focus on identified strengths and opportunities for improvement. As of this writing, we have noted that more than half of the Division and Directorate Level 1 business plans, and all Management System plans have identified opportunities for performance improvement. The majority of these improvements are internal to the organization (locally manageable) and do not apply to the Laboratory as a whole. An obvious exception is the PAAA issue. The business risk to the Laboratory will increase when pending legislation to eliminate the Laboratory's current exemption from civil penalties is introduced in Congress. References to PAAA in business plans is a very positive sign and is indicative of improved awareness which was an area of focus for IO in FY2001. As was the case in FY2000, there continues to be variability among the level of detail documented in individual plans. In those cases where very little performance related information was articulated, we could not provide a meaningful evaluation. This lack of detail could be due in part to the efficacy of the guidance and tools provided



to business planners. Additionally, many more organizations are using some form of a performance dashboard to understand and communicate performance results. In some cases, reviewers of business plans were directed to those dashboards. It is clear that our planning and assessment tools will need to continue to evolve in response to user input. Overall, results indicate that the Laboratory continues to make solid progress in the continued maturation of its self-assessment process – especially when compared against our ever increasing expectations for best-in-class performance in this area.

**External Oversight:** The depth, breadth, and number of external oversight activities, with the exception of DOE RL Facility Representative surveillances, have remained relatively constant over the past several years. There does not appear to be a formally organized external oversight effort, and no one area of focus appears to dominate. The general tenor of FY2001 external oversight reports indicates that PNNL continues to improve in almost all aspects of its operations, and our overall performance has generally been rated “Satisfactory” to “Outstanding”. With the exception of the Facility Representative surveillances, external oversight organizations are not finding trends that the Laboratory has not already identified through the Integrated Assessment Program (IAP). Additionally, the Assessment Tracking System (ATS) is being used more extensively for follow-up to external oversight reports. The reports indicate, however, that analysis and trending of external oversight data need to be more formalized at the Laboratory level; and external oversight data should be more systematically incorporated into organizational self-assessment program planning and execution.

As noted above, the Facility Representative surveillances appear to have increased. However, it is important to point out that this daily oversight activity has changed substantially. In mid-FY2000, the Facility Representative surveillance process was transferred to DOE-OPE and became highly formalized; surveillances are now a part of our formal commitment control process. Hence, they are now

captured as external oversight activities when previously they were simply a natural part of how we conducted business in partnership with DOE. This level of formality has driven more rigor and time into the process. Findings from the Facility Representative surveillance activities are addressed below.

## Operational Awareness

**Facility Representative Surveillances:** An IO Special Study was conducted in mid-FY2001 to identify any key trends that might require management attention. This study was supplemented by an analysis of results from Facility Representative Surveillances through FY2001 performed by the Facility Representative Coordinator supporting the IA MS. The combined results indicate the following themes:

- ◆ Occurrence Reporting, emphasizing event categorization
- ◆ Notifications to RL FacReps and to 375-2400
- ◆ Electrical Safety with emphasis on Lock and Tag
- ◆ Line management self-assessment
- ◆ Unreviewed Safety Question determination
- ◆ Radioactive Material Inventory process, and
- ◆ Work planning and control process

The majority of surveillances were conducted in the RPL. Hence, the RPL and F&O own the bulk of the surveillances.

The IO special study found that in their evaluation of operational performance, the results of Facility Representative surveillances indicated a level of performance consistent with or superior to the results of Laboratory Operations Managers’ evaluations, 74% of the time. In their evaluation of self-assessment performance, however, there are conflicting opinions as to what constitutes a specific performance level. In 21% of self-assessments reviewed, the Facility Representatives considered the self-assessments to be inadequate, while Laboratory management considered them to be adequate. These differing expectations of what constitutes each specific attribute of a performance



gradient (i.e., “poor,” “acceptable,” and “good” performance) represent a key opportunity for improvement in FY2002. Our review of results through FY2001 year-end continue to see this theme, which is also consistent with a key point highlighted in the procedural compliance special study that was previously discussed. The surveillances continue to be managed and dispositioned by appropriate line management. Improvements to the self-assessment process and the need to continue to resolve issues around differing expectations are highlighted in Part II of this report. Specifically, activity based assessments will have renewed attention in FY2002.

**RL Customer Satisfaction Survey:** This year, our survey population was considerably larger than in FY2000, and the response rate reached an all-time high (92%). Overall, survey results were positive. RL’s satisfaction with the degree of alignment between a Division’s/Directorate’s goals and those of the Laboratory has remained at the same high level indicated in FY2000. RL’s satisfaction with their overall level of involvement in Battelle’s self-assessment activities and use of assessment results to drive improvement are below FY2000 levels, but degree of satisfaction with the frequency of meetings is up. Several factors may be contributing to these results. The survey population was expanded this year, and the churn rate for RL counterparts was high. This year, one out of five (20%) of the RL counterparts were new, including

some who had been in the counterpart role for less than 3 months at the time of the survey. This change in survey population can have an impact on overall results, skewing comparisons between one year’s results and the next. Of greater significance than these perturbation factors however, is the one-on-one sharing of results between RL and PNNL staff that is an integral part of our survey process. This opportunity to clarify specific expectations more than offsets the changing survey population, and is truly an excellent example of using data gathered through self-assessment to improve performance. This information-sharing promotes the kind of working relationship between our two organizations that is held to be a significant component of the success of the Laboratory’s performance measurement system. See **Appendix C** for full analysis.

### **Summary of Progress Made Against Key Self-Assessment Improvement Themes**

In the FY2000 Annual Self-Evaluation Report, the Laboratory provided status on five key improvement themes originally identified as areas for improvement in FY1999. Since the themes represent important characteristics in a performance measurement system we continue to monitor our progress. Table 1 below summarizes those improvement themes and the progress that has been made to date.

Table 1. Status of Key Improvement Themes

Key Measurement System Improvement Themes	Progress in FY2001
Measurement System Alignment: Performance measures that clearly align to support an organization's strategic objectives/intents, management system performance, functional/daily operations, technical thrusts, and Laboratory initiatives.	<ol style="list-style-type: none"> <li>1) A strength, noted by an independent evaluator in FY2000 (Ken Mandley), that was evident in business plans for FY2002 in performance measurement is our comprehensive look at overall organizational performance, as well as connection to division, directorate, and group-level assessment.</li> <li>2) Also, the question in this year's annual DOE-RL satisfaction survey: "To what degree do you see alignment between what your Battelle counterpart is measuring and any relevant strategic goals that the Laboratory is trying to achieve?" In response to this survey question the majority of respondents rated alignment as Excellent to Outstanding."</li> <li>3) Analysis of business plans indicates that many business plans show linkage between POIs and both the Laboratory Strategy as well as the component strategy. However, the degree to which each business component adequately addressed the information requested was uneven.</li> </ol>
Cost of Improvement Options: Cost or financial understanding of improvement options is developed.	<ol style="list-style-type: none"> <li>1) The Laboratory's Operations Improvement Initiatives (OI) process continues to include the following criteria to evaluate improvement options submitted as proposals to the Laboratory's Leadership Team: impact/value to the Laboratory; return on investment; management system budget reductions; alignment with Laboratory strategy; urgency; and cost/difficulty to implement.</li> <li>2) Additionally, a separate section in the business plans asks specifically for information regarding improvements planned in the next fiscal year that will utilize existing resources (i.e., non-OI).</li> <li>3) The analysis of the business plans indicated that several organizations were able to articulate how certain process improvements were able to reduce costs (e.g., Finance, SBMS). Other organizations were able to identify how additional investment might improve the utility of a process or tool across the Laboratory (e.g., Integrated Assessment, Training and Qualification).</li> </ol>
Use of Comparative Data: Comparative data from external competitors (e.g., other national laboratories) or benchmark companies is used to evaluate the relative value of PNNL's performance. Best practices from other organizations are used to set improvement objectives.	Among the Divisions and Directorates there is a noticeable increase in using data from other organizations as a means to set realistic targets and understand the relevance of our performance results. A growing interest in benchmarking is also apparent as evidenced by several requests throughout the year to participate in benchmarking activities sponsored by The Benchmarking Exchange (TBE), a consortium of organizations from the private sector and government. At a minimum, ES&H, Finance, F&O, Integrated Planning, Integrated Assessment, SBMS, Communications, and Training and Qualification have used comparative and/or benchmarking activities to better understand and enhance their performance. Division comparisons are also made routinely in areas such as scientific productivity. The Laboratory will continue to participate in a benchmarking activity, coordinated by Sandia, that emphasizes S&T set productivity.
Use of Analytical Processes: Methods used to analyze data, such as cause-effect correlations, trends, projections, comparisons used to evaluate data and support decision making. Trending performance is prevalent.	<p>We continue to improve our methods for analyzing data. IO efforts, utilizing both internal and external SMEs have provided a better context for several of our measures. The IA MS is also developing a CAMs strategy that will ultimately result in improvements in the analytical capability of the ATS.</p> <p>FY2001 Critical Outcome reporting indicates a far greater emphasis on analytical approaches than previously reported. Tracking and/or trending is apparent in more areas than previously discernable. (Safeguards and Security, etc)</p> <p>Many organizations now have performance results links (e.g., ETD, ESTD, F&amp;O, ES&amp;H), additionally, a large number of organizations provide Lab-level performance results (e.g., FSD, ES&amp;H, F&amp;O, IT, SAS, Science Ed and University Collaborations)</p>
Deployment/Staff Involvement: The majority of staff are not involved in the development or monitoring of an organization's performance measures. Staff are unclear about how their contributions support the achievement of their organization's high-level strategies and objectives.	<ol style="list-style-type: none"> <li>1) Won VPP award that hinges on staff involvement. Staff involvement was also critical to the FEMP award.</li> <li>2) Staff engagement, as evaluated by Gallup, is high by most standards. They understand quality and see it in their peers.</li> </ol>



# **Appendix A**

## **Results of Peer Review**

## **Results of FY2001 Peer Review**

### **Contents**

- I. Overview of the Peer Review Process
- II. Scope of FY2001 Submission
- III. Laboratory Review Committee
- IV. Division Review Committees
  - Energy Science and Technology Division
  - Fundamental Science Division
  - National Security Division
  - Environmental Technology Division
- V. External Peer Review of PNNL Programs
  - Chemical Physics Program
  - Materials Science Program
- VI. Peer Review of New Proposal Submissions
- VII. Overall Assessment of Results of Peer Review
- VIII. Appendices

## Results of Peer Review

### I. Overview of the Peer Review Process

Peer review is one of the most universally accepted methods to determine the direction and assess the quality of science, engineering and technology. As one of the Department of Energy's (DOE) national laboratories, Pacific Northwest National Laboratory (PNNL) is committed to the principals and practices of peer review. PNNL's peer review process has both internal and external components.

Laboratory-initiated peer review has three primary components:

- ♦ The Division Review Committees (DRCs),
- ♦ The Laboratory Review Committee (LRC), and
- ♦ The internal peer review of communications sent by Laboratory personnel.

Each Laboratory Division has established a DRC to review its science, engineering, and technology portfolio, and the DRC chairs serve as members of the LRC. Both committees report to the Laboratory Director. Each of the above three components has been formalized and documented by publication in the Laboratory's Standards-Based Management System.

Major DOE programs (usually the Office of Science) are reviewed annually by panels of subject matter experts. Special reviews are also scheduled by DOE as the need arises.

Finally, the Laboratory also establishes special *ad hoc* internal review committees to address specific submissions of proposals in response to request for proposals (RFPs) for major programs announced by Laboratory sponsors of research and development (usually DOE).

### II. Scope of FY2001 Submission

Included in this report are summaries of the (1) proceedings of the LRC, (2) proceedings of the DRCs, (3) results of DOE-initiated peer reviews, and (4) results of special *ad hoc* internal review committees.

### III. Laboratory Review Committee

The Laboratory Review Committee (LRC) met with Laboratory Director Lura Powell and her Associate Laboratory Directors (or their representatives) on September 7, 2001. The proceedings (reviewed prior to release by LRC members for accuracy and attribution) of the meeting are summarized in Appendix 1. The Director presented an update of the Laboratory's strategic plan and her expectations for the DRC process and the LRC. The format was the same as last year's meeting in which each of the Associate Laboratory Directors presented the major issues identified via the DRC process in their respective Division and a summary of actions taken on last year's issues. These will become the issues on which the Divisions will concentrate their efforts in responding to DRC reviews and recommendations therein. The major issues of each Division and the Division response thereto are included as Appendix 2 to this report.

In addition, a number of changes in the DRC/LRC process will be implemented during the next fiscal year (Appendix 1). One of the prominent changes that will be made is lengthening DRC member's term of service from five to six years. The rationale for the change and the other items discussed are documented in Appendix 1.

### IV. Division Review Committees

Division Review Committees for each of the Laboratory's four technical Divisions met during FY2001. The results of these reviews and the prominent DRC recommendations are summarized below. Consistent with the formal FY2000 MOU, the Laboratory and DOE-RL shared DRC reports. As a result, this document will present a high-level summary since the DRC reports are readily available to DOE staff interacting with each of the Divisions.

#### Energy Science and Technology Division

**Review Scope:** The Division's DRC met May 16-17, 2001. The DRC assigned ratings to each of the program components reviewed. This DRC provided at ESTD request additional descriptors for factors not routinely included in



the process. Program components reviewed were (1) Photonic Thin Film Materials, (2) Material Interfaces, and (3) Energy Materials. The ratings are summarized in the table on p. 3 of the DRC report.

### General Comments on Technical Programs:

With agreement of its members, the DRC provided performance descriptors for a number of areas that are summarized for all three programs in the Executive Summary. The DRC “felt strongly that the quality of work being performed, the personnel, and the relevance of the work to the lab mission are all first rate” and assigned descriptors of outstanding to the quality of science and personnel of all three areas and excellent (1) and outstanding (2) for relevance to lab mission. The question of “missing personnel” dealt primarily with availability of support staff for the principal investigators, and the “adequacy of resources” dealt with availability of discretionary funds.

The DRC noted the need for more time for the review. Discussion of the other areas to which the DRC applied performance descriptors is included in the text below for each of the topics reviewed.

### Specific Comments

#### *Photonic Thin Film Materials*

- ♦ The committee was impressed with the overall quality of science/engineering, and the Division makes important contributions in the highly competitive area of OLEDs.
- ♦ The personnel have a very high level of competency, are dedicated, and publish in high quality journals.
- ♦ The DRC found that the area of external relations lacks a clear sense of outreach and articulation and is one in which significant improvements could be made. **Recommendation:** PNNL should foster closer ties with universities in the five state area of Washington, Oregon, Idaho, Wyoming, and Montana as well as California.
- ♦ More support staff and junior scientists are needed. **Recommendation:** The effort should recruit and fund more undergraduate and graduate students as well as postdoctoral fellows.

#### *Energy Materials*

- ♦ The overall quality of energy conversion (primarily development of solid oxide fuel cells) is “simply outstanding.”
- ♦ In emissions reduction, PNNL is playing a key role in several thrust areas, and the work is outstanding.
- ♦ Lightweight materials work centers around its integration into the transportation sector through modeling and manufacturing expertise. The work is outstanding.
- ♦ The DRC noted that the majority of the professional staff is recognized in their areas. **Recommendation:** The DRC strongly supports the concept of a “National User Facility” for the SOFC.

#### *Materials Environment Interfaces (MEI)*

- ♦ The group has a long history of significant scientific and technical accomplishments and the quality is outstanding.
- ♦ The MEI has stable scientific and technical leadership.
- ♦ The group is extremely effective in both the experimental and computational aspects of material performance.
- ♦ The work is more comprehensive and coordinated than other similar programs elsewhere and is in “an area where PNNL holds a unique and strategic advantage.” **Recommendation:** The current hot cell capability must be maintained. If lost, it would greatly compromise the program.
- ♦ **Recommendation:** The DRC strongly endorses the plan to establish PNNL as a user center for examination of irradiated materials, and PNNL’s commitment should be both funds and people.

The reader is referred to the report for more detailed comments on projects reviewed during poster sessions.

Response to 2000 review: The Division’s response to last year’s review was presented at the LRC meeting and is summarized in Appendix 2. The Division chose this method of presentation rather than at this year’s DRC meeting because it now has

three review committees, one each for the three business areas. Last year's review was on information sciences, a subject that the members of this review team could not adequately address.

## Fundamental Science Division

**Review Scope:** The review was held May 9-10, 2001. Components of the review included the Biomolecular Networks Initiative (BNI), computational science/engineering, Joint Global Change Research Institute, environmental chemistry and microbiology, and molecular biosciences/toxicology, and the EMSL Collaboratory.

**General Comments:** Environmental and microbiology were rated outstanding, and the Joint Global Change Research Institute was rated excellent/potential to be outstanding. Computational sciences and engineering, molecular biosciences/toxicology, and the EMSL Collaboratory were all rated excellent. With a new leader, the DRC felt the BNI had an emerging program that was too premature to rate.

### Specific Comments:

#### *Division Overview*

- ♦ Commended the ALD for implementing a needed restructuring while retaining key personnel.
- ♦ A top priority is filling of senior leadership positions with superior candidates.
- ♦ Commended the Division on completion of the User Housing Facility, creation of the new joint research institutes in global change and nanoscience, and winning a "plethora of impressive awards" by Division scientists.

#### *Biomolecular Networks Initiative*

- ♦ The BNI is an ambitious systems biology program and a clear fit to OBER's Genomes to Life Program, the primary new DOE program in post-genome era research and development.
- ♦ The DRC was pleased with the plan to apply unique PNNL technology.

- ♦ With "fierce" competition in government, academia, and industry, the DRC was pleased that an external advisory panel is being used to support the effort.
- ♦ The DRC was impressed with the NMR and mass spec facilities.
- ♦ **Recommendations** included (1) adding additional members to the advisory panel, (2) consider systems integration with prokaryotes and pursue eukaryotic systems in parallel as key staff are hired and facilities for expansion are identified, (3) develop short term deliverables and focus, (4) continue aggressive attempts to obtain more NIH funding and collaborations to capitalize on recent successes with NIH, (5) give highest priority to recruiting a strong program manager, and (6) tie BNI tightly to DOE missions and Hanford.

#### *Computational Sciences and Engineering*

- ♦ The reorganization and centralization of these resources is a logical decision, but concerns were raised about the potential of isolation.
- ♦ A domain-specific supercomputing capability is a centerpiece of PNNL's computing program, and the DRC supports this concept.
- ♦ **Recommendations** included (1) monitoring of potential isolation of the group and integrate efforts of the group with the rest of the Division, (2) including genomics and proteomics as key domains for future development, and (3) hearing more about the computational effort associated with BNI.

#### *Joint Global Change Research Institute*

- ♦ Impressed with vision and progress to date.
- ♦ Given the quality of leadership and commitment of the University of Maryland, it should be an excellent test for the joint institute concept.
- ♦ **Recommendation:** ensure continued spirit of cooperation between the institute and Richland personnel.

*Environmental Chemistry and Microbiology*

- ◆ The quality of science and people is world-class and the research could not be more relevant to DOE and Hanford
- ◆ It is a unique asset that needs to be nurtured and grown.
- ◆ Should be presented in the strongest light to DOE as a centerpiece in PNNL's portfolio.
- ◆ The geochemistry component is a strong and unique resource.
- ◆ **Recommendations** include (1) recruiting a genomics expert, (2) using the microbiology dynamics facility, which the DRC endorses, for in-house research, not a user facility

*Molecular Biosciences and Toxicology*

- ◆ Excellent presentations demonstrated continued progress.
- ◆ DRC believes that increased staffing and more modern facilities are essential. (**Note:** GPP funds have been allocated for the rehabilitation of 331, and renovations are taking place as quickly as resources will permit.)
- ◆ **Recommendation:** present a plan to recruit additional staff at a future review.

*EMSL Collaboratory*

- ◆ DRC was impressed with the suite of tools but was less clear on their usefulness.
- ◆ The group was less clear on the usefulness of the tools to internal & external users.
- ◆ **Recommendations:** in a future review, focus the presentations and present a critical evaluation of competitive programs as well as commercial software and vendors.

Subject area recommendations are noted above, but the DRC made some additional general requests for topics at future meetings.

- ◆ The DRC would like to review functioning of reorganized Division and how it aligns with the major funding agencies.
- ◆ EMSL issues include (1) better understanding of how time allocation and priorities are managed for internal & external users (2) urge DOE to

consider a capital renewal program for EMSL, (3) selected program areas like proteomics require more space and time than can be accommodated in a user facility. Parallel facilities for specific functions are endorsed by the DRC

- ◆ Present an update on space planning at next meeting.
- ◆ Present staffing demography for reviewed units at future meetings.
- ◆ Present a summary of initiatives used to develop the "DOE interface."
- ◆ Present a number of requests under "meeting logistics."

**Response to 2000 review:** The DRC stated that there "was impressive follow-up activity in response to all the recommendations." The Committee "compliments the Director for his attention to its recommendations." Additional documentation on Division actions in response to this review is provided in Appendix 2.

**National Security Division**

**Review Scope:** The review was held June 5-7, 2001. The format of this year's meeting was changed from that used in the past in that only part of the review was devoted to quality of the Division's science and technology. The remainder of the review dealt with the discussions on development of NSD's strategy for its national security mission and the meeting with Lura Powell.

**General Comments:** The overall rating assigned to the NSD programs reviewed was excellent-outstanding. Comments on specific programs and discussion topics are summarized below. Also included in this year's report for the reader's information are the comments recorded during the roundtable sessions from which the text in the body of the report was derived.

**Specific Comments:***State of the Division*

- ◆ The ties between the needs of the national security mission and the core competencies of PNNL are becoming more pronounced.

- ♦ The Division has successfully launched several key science and technology initiatives in addition to its national security mission.
- ♦ The DRC viewed the changes made in the reorganization of its technical groups, reduction of product lines, and addition of new DOE accounts as beneficial to the Division.
- ♦ The DRC commended NSD for having addressed past strategic planning difficulties.

### *Nuclear Science and Technology*

Much of PNNL's nuclear capability has recently been consolidated within NSD. The budget of this product line is about \$120M, and its portfolio is derived from four major programs. The DRC stated that in a relatively short time NSD has done an excellent job coordinating this effort and making a case that this is an important thrust area for the future. Reviewed projects within the programs are listed below.

- ♦ Tritium Target Qualification Project. This project is the second largest program in PNNL in terms of both FTEs and budget. The DRC believes that the program's technology is impressive and that the understanding of the PNNL staff of the "many, diverse aspects of the design, testing, and fabrication, and qualification process is excellent." NSD has demonstrated technical leadership and provided regulatory expertise. In summary, the DRC considers PNNL efforts to be outstanding.
- ♦ NRC-Environmental Assessment for License Renewals. This fee-for-service work would provide a constant, significant funding stream to NSD although there is no technology development component to the program.
- ♦ Soviet-Designed Reactor Safety. This is an INSP project to reduce operational risk at Soviet-designed reactors. The DRC believes this "is a very significant program in which PNNL is demonstrating excellent leadership.
- ♦ Nuclear Energy Research Initiative (NERI). The DRC reviewed four projects. (1) Novel Concepts for Damage-Resistant Alloys develops new alloys for reactor use and is "an outstanding project." (2) On-Line Intelligent Self-Diagnostic Monitoring for Next Generation Nuclear Power Plants is proof of principle project to detect degradation. The DRC thought the technology will have applications outside of nuclear power plants, but the DRC was not clear on PNNL's role. (3) Development of a Stabilized LWR Fuel Matrix. The project "is well conceived and will contribute to basic knowledge of nuclear material and of processing techniques." (4) Advanced Ceramic Composites. A project to discover radiation resistant materials, its "concept is sound and the potential results could be significant for reactor design."
- ♦ The NRC market sector (\$4.5M) has been relatively stable and the DRC sense is that there may be future opportunities. The program's several key technical accomplishments "stand out as providing important service to the NRC and reflect a level of competence and quality that is commendable." The DRC regards the NRC sector program "as sound, valuable, and capably managed."
- ♦ Radiochemistry Processing Laboratory. The DRC noted that PNNL's facility is aging and must be upgraded and noted its relative low cost compared to similar facilities elsewhere. **Recommendation:** The DRC recommends "that a plan be developed for an upgrade but the upgrade should not be a top priority for the immediate future unless the 300 area becomes part of a D&D process." In a separate but related discussion the DRC pointed out that in addition to facilities concerns within this area is the fact that the pipeline of newly trained radiochemistry scientists is virtually empty and universities are no longer training graduate students in this discipline.

Associated with this mission area is the "Advanced Nuclear Science and Technology Initiative (ANSTI), a proposed LDRD program. The DRC endorsed ANSTI and its primary focus areas. Further, the DRC believes that PNNL currently has facilities and skills that could be marshaled in this effort. However, the DRC did support the three basic science research experiments in the Initiative noting that the science was excellent but confused the Initiative focus. **Recommendation:** NSD should seek funding elsewhere and partner with several universities.



## National Security Mission

Much of the discussion and individual comments upon which the text below is based have been recorded in the appendix to the report. Following are the DRC comments and suggestions. As a process comment, the DRC also suggested use of a moderator to keep discussions at the appropriate level.

- ♦ Developing a distinctive NSD/PNNL signature with NNSA. NSD must understand NNSA needs and priorities, initiate an aggressive marketing effort and correct the present lack of communication to NNSA of Laboratory strengths. **Recommendation:** NSD should also seek other funding outside of NNSA and NN.
- ♦ The role of PNNL in the 21<sup>st</sup> century military. The DRC again pointed out that aggressive marketing and communicating PNNL strengths are absolutely necessary and that a niche with one service (Army) will not enable growth of a larger program.
- ♦ Critical infrastructure and asset protection. The market is very fragmented, and this will be a problem. **Recommendation:** NSD should consider targeting owner(s) of the infrastructures who indeed have all the funding.
- ♦ Non-traditional proliferation prevention approaches. The Committee felt that NSD's example was not a fit to the strategic area. Before the DRC engages in another similar discussion, it must acquire a full understanding of the strategy and the programs. **Recommendation:** Since the best opportunity to attract NNSA funding is through their NN work, NSD should assemble a briefing based on that experience and then press for a meeting with General Gordon.

In a discussion with Lura Powell, the DRC noted that the Director would like to see “enhanced science” conducted at NSD. The committee believes that the Director's greatest challenge is articulating “Why PNNL?” The committee recommended that NSD be included in more Laboratory promotional material to demonstrate its interest in NSD in addition to the focus area in which NSD has little or no part.

**Response to 2000 review:** The primary issues from the 2000 review were (1) alignment of NSD's management activities and (2) strategic planning effectiveness. With respect to (1), the DRC noted NSD has “become more cohesive and streamlined with innovative realignment of technical groups and the reduction in the number product lines (from 8 to 5). With respect to (2), The DRC “commends NSD management and staff for having overcome the numerous difficulties of the past in strategic planning.” Additional documentation on Division actions in response to this review is provided in Appendix 2.

## Environmental Technology Division

**Review Scope:** The review was held March 21-22, 2001. The DRC was given a three-part charge by ALD Walt Apley. The charge included (1) perspective on progress in implementing ETD's strategy, (2) feedback on areas of emphasis, and (3) comments regarding staffing potential-growth, quality, development, discipline.

**General Comments:** The DRC assigned an overall rating of “Outstanding” for the Division components reviewed. The DRC “was pleased to find that ETD had a renewed sense of vision and purpose, and that ETD's overall program was generally in excellent condition.” The Division is clearly benefiting from a stable management and consistent leadership and the team appears committed to moving the Division forward on many fronts.

**Specific Comments:** In response to the charge given by Walt Apley, the DRC provided the comments below.

*Is ETD delivering on previous expectations, and how can ETD improve its plan and execution?*

- ♦ The DRC believes ETD is “definitely delivering on the expectations created last year.”
- ♦ ETD's business strategy is clearly linked to DOE's mission and goals but not exclusively so (example Sequim Marine Lab)
- ♦ Compared to 1-2 years ago, a “considerable amount of staff empowerment” has taken place and morale is generally higher.



- ♦ The management team is functioning as a mature group.
- ♦ The ETD vision has a good start, and it is critical that ETD continue refining and working toward the vision.
- ♦ ETD can improve its plan and execution in the future by (1) improving and refining its plans as circumstances change, (2) raising its expectations on the quality of planning and strategic analysis (several initiatives at the review did not do so with respect to explaining ETD's role and comparative advantage).
- ♦ The DRC presented 4 unresolved issues that could impact the Division's ability to sharpen its focus (see report for detail).

*Do ETD's new areas of investment emphasis make sense?*

- ♦ The DRC believed that an increased role in Hanford, bio-based products, water resource management in Mexico City, and health effects research all made sense for ETD.
- ♦ The DRC did not believe a case was adequately made for ETD involvement in water resources business market and new facilities for the campus of the future.

*Is ETD's organization and staffing strategy configured well to address ETD's business strategy?*

- ♦ They answered yes to the above query and thought the technical resource units were appropriately constituted.
- ♦ The Division's current management team is superior and capable of addressing division issues.
- ♦ For the professional staff, recruiting and retaining key staff members along with recognition and promotion of existing staff are areas of DRC concern; however, the Division is addressing these issues.

*Comments on Technical Resource Units*

- ♦ **Systems and Risk Analysis:** ETD's mission and goals have been communicated and understood by this group. The "most striking" observation is the Unit's commitment to integra-

tions. Comments on each of the individual groups are also provided in the report. The DRC thought that this unit is providing good support for the Hanford missions and is developing strong cooperative programs with other PNNL Divisions. Their planning is an excellent way to achieve structure and focus. **Recommendations:** (1) Assure the unit's success by maintaining the focus it has achieved and (2) Showcase the Mexico City Project as a model.

- ♦ **Natural Resources:** The managers have made significant progress in the past year, and the team is a cohesive unit that communicates well together. This is a "major accomplishment", and they were congratulated. Several of the unit's new initiatives need to be fleshed out in more detail, and the reviewers were pleased that stewardship is on the agenda. **Recommendations:** (1) Increase the science base of the unit. An increase in LDRD would be of help as would a small tax on WFO. (2) Do some strategic hiring in ecological modeling.
- ♦ **Sequim Marine Laboratory:** The laboratory is slowly growing, and the downward slide has been reversed for which Dick Ecker and his team deserve great credit. The proposal for a "Marine Research and Biotechnology Park will require great effort to be successful, but is a creative approach." The absence of a clear DOE mission in marine sciences is a large obstacle. **Recommendations:** (1) Consider forming alliances with NOAA or the Corp of Engineers, (2) Develop a relationship with the local Congressman.
- ♦ **Process Science and Engineering.** There has been significant improvement in staff morale attributed to leadership of Walt Apley and Rod Quinn. The decision to reduce the number of groups was a good one, and the report of S&T issues related to Hanford Cleanup was clear in its identification of separations science as a major factor. The Bio-based Products Regional Center initiative appears to be a very good idea with strong technical components and its collaborative nature albeit putting together the collaboration is a slow process. With respect to RPL, it continues to be a leader in strategic planning, and

the proposed remodel of Bldg 325 is a good idea. The lack of DOE infrastructure funding is concern as are staffing issues. **Recommendations:** (1) Maintain stable leadership in the resource unit. (2) Consider whether the separations area is being given adequate support. (3) Broaden support of the Bio-based Initiative. (4) Develop and implement a specific strategy to address the personnel shortages in key technical areas. (5) Review the criteria for Level 6 status for relevance to ETD.

- ♦ **Response to 2000 review:** Last year's challenge of moving from strategic plan development to implementation and execution is well underway with several clear examples of successes. The Division is clearly benefiting from stable management and consistent leadership, and a solid management team has been put into place. In addition the DRC is very pleased that the division has had considerable success in addressing the roles for ETD at Hanford that lead to key assignments for ETD from the Office of River Protection and Bechtel Hanford. Finally, the need to PNNL and ETD to develop a stronger and more direct relationship with DOE-EM HQ continues to be a need and must receive priority attention. Additional documentation on Division actions in response to this review is provided in Appendix 2.

## V. External Peer Review of PNNL Programs

Each year Basic Energy Science reviews selected programs. The results of this year's reviews are summarized below.

### Chemical Physics Program, Office of Science, Office of Basic Energy Sciences, Chemical Sciences Division

**Review Scope:** The review of Molecular Theory and Modeling programs was held March 5-8. This year the OBES-sponsored and -staffed review of the program had three external reviewers who reviewed the projects of Sotiris Xantheas, Kirk Peterson, Liam Dang, Rene Corrales, Gregory Schenter, and the NWChem group (Jeff Nichols, Robert Harrison, and Edoardo Apra)

**General Comments:** As stated in the review summary, "This is a fine program fueled by a team of enthusiastic investigators with lots of ideas and energy" and "is distinguished by collaborations among the group and with the external scientific community." PNNL "should take great pride in an excellent scientific program that maintains both high scientific quality and relevance to the DOE mission."

**Specific Comments:** The reviewers noted that this was a mature program with the compounding problems of a diminished postdoctoral program and diminished technical support resulting from flat budgets over the past several years. The reviewers provided specific suggestions to address maturation and funding issues, the most prominent of which were to: (1) utilize EMSL's extraordinary computational and software tools to the fullest extent, (2) coordinate the group's activities towards solving a larger defined environmental problem, and (3) seek alternative means (in the face of flat budgets) of maintaining intellectual diversity.

**Response to review:** On September 26, 2001, the EMSL team responded to the review with a presentation to the BES Chemical Science leadership. To address the issues identified during the review, the Molecular Theory and Modeling Program presented a plan that (1) strengthens and coordinates among all the principal investigators fundamental new methods development (ab initio techniques) for the entire theory program, (2) better coordinates and integrates work of the theorists with the experimentalists, (3) and enhances intellectual diversity with the addition of Michel Dupuis as a senior investigator and Professor Ernie Davidson (UW) as a consultant to provide program and management guidance to the group. The plan was readily endorsed by BES managers.

### Materials Science Program, Office of Basic Energy Science, Materials Science Division

The review was held June 13-14, 2001. This is an annual review in which BES projects are examined every 2-3 years. This year the OBES-sponsored and -staffed review had three external reviewers who reviewed "Molecularly Organized

Nanostructural Materials, Chemistry and Physics of Ceramic Surfaces,” and “Fundamental Studies of Stress corrosion and Corrosion Fatigue.”

**General Comments:** It was noted that the fact that Lura Powell gave the introduction was “impressive and surprising” and indicated “the importance of this basic program to the upper laboratory management.” It was noted that the programs form an important part of the DOE basic research and that PNNL is helping DOE in a number of ways in addition to the projects themselves. In general the budget for the work don’t appear to be adequate but that “progress is remarkable.”

### Specific Comments:

#### *Molecularly Organized Nanostructural Materials*

- ♦ This is a well-focused effort.
- ♦ The group’s contributions are highly rated as judged in part by publications in peer-reviewed journals.
- ♦ Highlight of the work is ability to prepare ceramic structures that reproduces the biological structure of wood.
- ♦ **Recommendation:** Researchers should continue to think about applications of the work.

#### *Chemistry and Physics of Ceramic Surfaces*

- ♦ The work has important implications in catalysis, materials synthesis the environmental science.  
**Recommendation:** The goal of this effort should be to use the knowledge of adsorption and dissociation to understand how they influence chemical reactivity.
- ♦ This group is carrying out good research of importance in determining the properties of metal oxides.
- ♦ These studies make use of PNNL’s outstanding surface science facility and are probing some fundamental questions about structure and bonding at surfaces.

#### *Fundamental Studies of Stress Corrosion and Corrosion Fatigue Mechanisms*

- ♦ The group has an excellent reputation and is continuing its excellent work providing new

insight to corrosion behavior in a system technologically important.

- ♦ The PNNL group is among the leaders in the field.
- ♦ This program continues to be an innovative and outstanding one at PNNL with outstanding staff.

#### *Irradiation-Assisted Stress Corrosion Cracking*

- ♦ This is an outstanding piece of work that deals with important basic science issues that are also technologically relevant.
- ♦ PNNL researchers have been and continue to be leaders in this field. Their work is very innovative, and PNNL is the only place where it could be performed.
- ♦ The program appears to be on the way to answering fundamental questions.

#### *Interfacial Dynamics during Heterogeneous Deformation*

- ♦ The work on grain boundaries is an important step in developing predictive systems.
- ♦ The program has the right blend of experimental and simulation work.
- ♦ The theoretical treatment of the crystallography and its experimental observations is very impressive, is the first in this field, and should have great impact on this field.
- ♦ One of the great strengths is the combination of modeling with experiments. **Recommendation:** Bring in some electronic structure theorists at PNNL to work on this problem as well.

#### *Bulk Defects and Defect Processes in Ceramics*

- ♦ Work in this area continues to be outstanding, and Weber’s group is a worldwide authority in this area.
- ♦ The group contributes excellent integrated efforts of computational and experimental research.
- ♦ The proposed future attempts in treating oxides are highly encouraged.

**Response to review:** The report was received relatively recently, and the response is still in preparation.

## VI. Peer Review of New Proposal submissions

Each year the Laboratory responds to solicitations for proposals to major DOE programs. The Laboratory has established a vetting process that is administered by ad hoc internal review committees. Only the most meritorious proposals are selected for communication to the sponsor, and this process has significantly improved the competitiveness and successful outcome of the proposal production process. Although proposal success rate data are not readily available for most funding agencies, the National Institutes of Health (NIH) is a conspicuous exception. NIH is considered to be the premier example of scientific peer review, and the National Cancer Institute is by far the largest NIH Institute. Over the past 5 years for which data are available (1995-2000), the NCI RO1 proposal success rate ranged from 25-31%. NCI RO1 proposals are most similar to those submitted by PNNL.

**Environmental Management Science Program (EMSP):** This year was amazing. Overall, this underscores that PNNL understands DOE's environmental problems. For example, (1) PNNL won 9 of 20 high-level waste proposals funded this year (45% success) and 2 of 8 Decontamination and Decommissioning proposals submitted (20% success). Overall success rate for the 28 proposals submitted was ~40%. PNNL also gained 5 wins where other institutions had the lead. (2) These wins will bring \$7.93M of new funding into PNNL. (3) It appears that ~\$16M was available for distribution to all the national laboratories. PNNL won ~50% of all dollars available for competition.

**Natural and Accelerated Bioremediation (NABIR):** PNNL has six projects (of eight submitted) funded for a total of \$1548K/yr. The Laboratory also has continuing funding for projects that were not up for renewal. PNNL continues to be the institution with the largest NABIR-sponsored portfolio.

**The Microbial Cell:** The only proposal PNNL communicated to OBER was funded at \$1.5M/yr with \$600K capital equipment. Jim Fredrickson was also appointed OBER program coordinator for complementary work at ORNL and UW.

**The Microbial Genome Program:** PNNL submitted 5 proposals to OBER of which two were funded for \$898K. This is an important win for the Laboratory since these are the first genome proposals funded here. This is a culmination of the effort of years by a number of individuals to acquire expertise and credibility in research areas for which PNNL has not traditionally been known.

**Low Dose Radiation Research Program:** Two solicitations (RFPs) were issued by OBER under this program. For the "Pilot Modeling Projects" RFP, OBER received 19 proposals, seven were funded, and two of these were PNNL proposals (of 4 submitted). The estimated level of funding is approximately \$550K/yr.

For the "Basic Research" component of the low dose RFP, OBER received seventy proposals, nineteen were funded (many of which were continuation projects), and two were PNNL proposals (of five submitted). The estimated level of funding is \$550K/yr.

**Nanoscience Engineering and Technology:** One of four proposals submitted to BES was funded at \$750K/year.

**Scientific Discovery Through Advanced Computing:** The Office of Science issued six coordinated grant solicitation notices with a combined value of \$53 million for this new program. In response, PNNL participated in 14 proposal teams. Each team had from 2-9 institutions (typically DOE laboratories and universities). Ten of these project proposals were funded, in whole or in part, yielding \$1.4M in new partial-year funding in FY2001 and \$3.2M in FY2002. Over the proposed 3-5 year lifetime of these projects, PNNL expects to receive over \$12M. The funding comes from ASCR (\$10.7M), BES (\$0.9M), and BER (\$0.6M). PNNL is now involved in an array of the most important computing projects in DOE-SC, with collaborations with other leading scientists at DOE laboratories and universities across the nation.



## VII. Overall Assessment of Results of Peer Review

The Laboratory continues to honor its commitment to the peer review process. It is important to reiterate that interactions between Laboratory and DOE-RL staff during formalization of the peer review program led to creation of a program in which the process itself and the utilization of derived information are the most important elements. The descriptors/rankings applied to the science and technology work reviewed are useful and informative to identify issues that must be addressed but in themselves neither drive the process nor provide its most important product.

During FY2001, all Laboratory commitments with respect to peer review were completed:

- ♦ **Laboratory Review committee (LRC):** The annual LRC meeting was held September 7, 2001. The proceedings of the meeting are attached as Appendix 1, and the primary issues from the 2001 DRC reviews and the Division actions taken on 2000's primary issues are summarized in Appendix 2. This year's LRC meeting was the first attended by DOE-RL representatives. This meeting was in many respects an extraordinary one. There was no doubt that the LRC members were highly engaged during discussion of the primary issues raised by the DRC and Division actions taken thereon. Each DRC chair shared what they believed was the highest priority for their respective Division, and the LRC shared some very gratifying comments on the Laboratory's values and character.
- ♦ **Division Review Committees:** The Laboratory-initiated external peer review by DRCs was completed. DRCs of each of the Laboratory's four technical Divisions met during the year and reports of the review results were prepared and communicated to the Divisions and their respective DOE-RL representatives. Performance descriptors assigned were: "Excellent to Outstanding" for ESTD, "Excellent to Outstanding" for FSD, "Excellent to Outstanding" for the NSD, and "Outstanding" for ETD. Each

of the Divisions responded to DRC issues and recommendations of the previous year's meeting, and each DRC commented on the quality of the response.

- ♦ **Sponsor-initiated review of PNNL Chemical Physics program:** The acting BES division director noted, "This is a fine program fueled by a team of enthusiastic investigators with lots of ideas and energy."
- ♦ **Sponsor-initiated review of Materials Science Program:** The reviewers noted "the programs form an important part of the DOE basic research and that PNNL is help DOE in a number of ways in addition to the projects themselves." In general, the reviewers commented on the excellent reputations of those practicing the science.
- ♦ **Response to DOE Solicitations:** The Laboratory responded to seven major DOE solicitations using its now standard process of ad hoc internal review committees (see p.11-12). The successes were gratifying. It is clear that the proposal vetting process is working very well.

The Laboratory's performance in "Results of Peer Review" is outstanding. All commitments were completed. The Laboratory Review Committee and Division Review Committees discharged their responsibilities. Each Division responded to DRC observations/recommendations from last year's review both to the DRC and through the LRC process as well. The performance descriptors applied by the DRCs to Divisions activities ranged between "Excellent to Outstanding." All sponsor-initiated reviews were completed and where time permitted actions were taken on the recommendations. Finally, the Laboratory's success in attracting new programs via major DOE solicitations administered by special ad-hoc internal review teams was outstanding. Clearly, an organized and rigorous process for preparation of research proposals has yielded great returns for the Laboratory.

This year's LRC meeting was very gratifying and valuable. The LRC's comments on the values and character of the Laboratory and its staff were spontaneous and heartening. In addition, the LRC meeting as a forum for sharing information with



PNNL senior management and DOE-RL staff has proven its worth. The suggestions for process improvements and sharing Laboratory-wide issues and actions clearly demonstrated the Laboratory management's commitment to using the results of the peer review process in the life of their respective Divisions and the Laboratory as a whole.

Special note should be taken of Director Lura Powell's extraordinary engagement in the peer review process. This was the subject of many comments in this year's DRC reports and the LRC proceedings. It is obvious that the DRC chairs and members value that engagement, and it clearly shows the Director's commitment to and value of peer review by outstanding scientists. It is the Director who by example communicates to the staff and management the elements important in defining the character of the Laboratory.

## Appendix 1

### Laboratory Review Committee- Meeting summary prepared by Ron Walters

Following is a summary of the September 7, 2001, meeting of the Laboratory Review Committee. Division Review Committee (DRC) chairs present were Wayne Heubner (ESTD), Mike Hochella representing Steve Brenner (EHSD), Carl Poppe (NSD) and Ed Berkey (ETD).

This summary is organized by subject area rather than by the temporal order of presentation or discussion at the meeting, as those attending will readily recognize. This method of reporting was chosen to more effectively capture the rather wide-ranging discussions.

### Presentation by Laboratory Director Lura Powell

Dr. Powell presented highlights of some of the Laboratory successes during the past year, shared highlights from the recent DOE Office of Science On-Site Review, and discussed the proposed Biomolecular Sciences Laboratory noting its strong support from DOE and NIH. The Laboratory's key issues for which Dr. Powell requested that future DRCs provide ideas and advice were:

- ♦ How does the Laboratory build a strong DOE-NIH partnership?
- ♦ How does the Laboratory best link its science and mission roles?
- ♦ How can the Laboratory convince its customers to step up their investments in the supporting research infrastructure?

Dr. Powell explicitly thanked the DRCs for their service to the Laboratory and cited their importance in shaping future directions of the Laboratory. She also cited several cases in which the strong and direct language of DRC reports would make a difference to DOE program managers and aid in interactions with them.

### The DRC/LRC Process

During the meeting, a number of process-related topics were raised and discussed. They are presented below.

- ♦ It was agreed that the term of service on DRCs should be extended from 5 to 6 years. Because programs are reviewed on a three-year cycle, a six-year term of service would provide more continuity within the DRCs.
- ♦ To help each DRC better understand the Laboratory as a whole, it should become a standard practice that at each DRC meeting an overview of another Division be presented by its ALD.
- ♦ DRC meetings should be scheduled sufficiently early in the year to allow Dr. Powell to make a presentation early in the meeting and to participate in the other activities, especially the closeout.
- ♦ Developing the DRC charge and agenda should be a team effort between the Division and the DRC chair.
- ♦ Noting that there was not much diversity (i.e. women and minorities) on the DRCs, the Director asked LRC members to help identify candidates that could address that issue.
- ♦ The LRC requested that the Director provide some budget information at the next LRC meeting and that each ALD also present similar overviews with their presentation. Accompany-

ing the budget overview could be some statements about what areas the Lab and/or Division wants to grow so that DRC members can assist in the outreach. The presentation should be at the “Scientific American” level (i.e. keep it simple).

- ◆ Regarding the relationship of the LRC to the Laboratory Advisory Committee (LAC), the Director noted they had different roles. The LAC has stated that it does not believe that an LRC representative on the LAC is appropriate although it would periodically like to have a report on the results of the DRC/LRC meetings.

### **Presentation of Prominent Issues of Each Division**

Based on the current DRC reports, each Associate Laboratory Director (or their representatives) presented this year’s major issues for their respective Division along with a short discussion of the resolution of last year’s issues. This information is summarized in Appendix 2 and will not be discussed further. The remainder of this section is a summary of the highlights of related items prompted by discussions following each ALD presentation.

### **Energy Technology Division**

- ◆ Efforts to prevent “stove piping” are laudable.
- ◆ ETD’s management makes the DRC more effective by providing clear-cut charges and including the DRC during development of the meeting agenda.

To the query of what during the next year is the single most important thing the Division needs to do (based on this year’s review), Dr. Berkey replied that the Division must continue to serve its EM client (as it should) but there’s a life after EM, and the Division needs to be ready for the transition. They must however continue to treat EM as a prized customer.

### **Energy Science and Technology Division**

- ◆ The Division has re-oriented its DRC to more effectively deal with the Division’s major busi-

ness units. In practice, the Division has a review committee for each of its units.

- ◆ About 70% of DRC members now have collaborative projects with Division staff.

To the query of what during the next year is the single most important thing the Division needs to do (based on this year’s review), Dr. Heubner replied that the Division could mine its materials science portfolio if more resources and external marketing were available. Other major laboratories are shrinking their materials science organizations, and PNNL could take advantage of that.

### **Fundamental Science Division**

- ◆ Every major point of the DRC report was described to the LRC in detail. All recommendations within the report had been studied and in some cases acted upon.
- ◆ The Division’s DRC needs the computational scientists that are to be added.
- ◆ For FSD programs, DRC rankings of outstanding and excellent were not reflections of “grade inflation.” This remark was prompted by a discussion of how performance descriptors are generally understood within DOE as a whole. Debbie Trader can provide additional details to the reader since she participated in the discussion, but the bottom line was that within DOE a descriptor of “good” really meant the program/project was in trouble.

To the query of what during the next year is the single most important thing the Division needs to do (based on this year’s review), Dr. Hochella replied “firmly establish the direction and find strong leadership for the biological sciences that will allow the Biomolecular Networks Initiative (BNI) to flourish. The BNI would make this Laboratory truly unique.” The Initiative is capitalizing on the health science trend that is going to have financial support in the future, especially proteomics and cell signaling. He saw “dramatic glimmers of strength, but the Laboratory is not yet where it needs to be.” The Laboratory cannot wait long or the “train will leave the station.” “Leadership hires are crucial.”

## National Security Division

- ♦ The great value that off-cycle visits to PNNL by DRC members was reiterated.
- ♦ In view of the facts that (1) about half of the Laboratory's funds come through NSD and (2) PNNL is an Office of Science Laboratory rather than a Defense Programs Laboratory, what is the process used to develop the strategy to evolve and change the portfolio? The Director replied that decisions are based on (1) DRC input, (2) Division strategies, (3) Laboratory-level strategy development, and (4) input from DOE program personnel.
- ♦ With respect to recruiting and retaining staff, if this remains an issue, the Laboratory needs a plan. The director replied that the Laboratory's recruiting effort is now more focused. In addition, the postdoctoral fellow program has been brought into the Laboratory, and that may help as well.

To the query of what during the next year is the single most important thing the Division needs to do (based on this year's review), Dr. Poppe replied that the Division should "define the signature of why NNSA should support PNNL instead of exclusively supporting weapons laboratories."

### *Remarks on the Laboratory's Values and Character*

During the course of the meeting, LRC members shared a number of remarks concerning the Laboratory's values and character that I believe should be captured. Dr. Hochella said that "of the three national laboratories he knows well, PNNL is the only one in which he has not seen deadwood. This Laboratory has more of a tough research university feel than any other he knows. Scientists here feel the intense pressure to produce just like their academic colleagues struggling to get tenure and programmatic support; and that's the way it should be."

In related remarks, Dr. Berkey reiterated the "no deadwood" comment and said that PNNL staff members don't expect entitlements (citing as an example our vetting process on major RFPs), and they are accustomed to competing. He also noted that the Laboratory's successes in responding to

RFPs are well known externally and urges the Laboratory to maintain its vetting process that selects only the best proposals for communication to funding agencies. He concluded by noting that "more than other national laboratories in his experience" the focus here is on high quality, from staff members up to management.

## Appendix 2 Prominent Issues of the Technical Divisions

### PNNL Division Review Committee Issues and Actions

*The following are the most prominent and recurring issues identified by each of the ALDs for their respective division. These were shared and discussed during the September 7 meeting of the LRC. The actions associated with last year's issues are documented below as well.*

### Energy Science and Technology Division

#### *FY2000 Issues and Actions*

1. Development of a coherent, common software architecture that crosses all three major thrust areas and serves as the foundation for a distinctive, integral software architecture:
  - ♦ Successfully conducted an international search which resulted in hiring Ian Gorton as Chief Architect of Information Science & Engineering (IS&E).
  - ♦ Leading a new BMI IR&D program that will design, develop and pilot a component architecture framework.
2. Developing a culture and processes that promote and capitalize on cross communication between developers and across programs.
  - ♦ Cultural issues extend beyond the walls of PNNL: we are also participating in a second large IR&D program at the Institute level that will utilize component architectures to assist in cross-organizational communication.
  - ♦ We also initiated a popular "birds of a feather" activity as part of the CS&I technical network that strives to promote communication between developers.

3. Evolution of the product line/organizational structure to clarify the role and recognition of information science & technology at the PNNL.

- ♦ More clearly defined the technical scope and mission of the IS&E Thrust Areas while simultaneously reducing the number of thrust areas from four to three.
- ♦ IS&E staff and management demonstrated active involvement and leadership in the Laboratory level Computational Sciences & Engineering Initiative as well as supporting the formation of the computational science organization within FSD.

4. Clarification of the key thrusts and approaches in cyber security to reflect the broader views and state of development in this area across industries and agencies.

- ♦ A break through workshop was held to redefine the technical and business vectors of this thrust area. The draft for our new strategy will be available in mid-September, 2001.
- ♦ Dr. Debra Fricke, leader of the University of Idaho's Center for Secure and Dependable Software has been retained as a consultant to serve as the "Cyber Security Chief Scientist" as we continue our search for a permanent staff member.
- ♦ During the past year we have created a new group with ~17 members in Cyber Security and changed the leadership of the associated Thrust Area. In addition a key staff member has transferred from ESTD to NSD to supply additional business focus and leadership in this market segment.

5. Development of a clear information sciences foundation strategy that will support the growth of stature of the lab beyond expert applications development to breakthrough technology development.

- ♦ We are working to accomplish this goal by continually refining the research directions of our thrust areas along with providing the necessary senior level leadership and financial support. The research directions defined

within each thrust area form the core of our long range science & technology strategy for this organization.

6. Enhancing the visibility of PNNL information sciences through enhanced publication and presentation efforts.

- ♦ Based upon the FY2000 peer review a series of management actions designed to increase publication and presentation rates were initiated:
- ♦ Organizational goals were established and communicated to line management and staff with regard to increasing the visibility of the IS&E unit through publications and presentations.
- ♦ Implemented a tracking mechanism for publications and presentations and communicated this approach to staff.
- ♦ Hired a communications specialist to assist staff and management in this process.

Since the cycle time associated with peer-reviewed publications is longer than the timeframe being reported here, additional time will be required for meaningful statistical data to emerge. However, early data shows approximately a 30% increase in performance predominantly in the Information Exploitation and the Large Scale Information Integration areas.

#### *FY2001 Issues*

1. Increase the focus on the Photonics area, including development of a 3-5 year R&D plan that builds upon existing capabilities at PNNL.
2. Maintain our traditional Energy Materials business lines; plan for expansion into new energy technology areas, including emissions and energy storage.
3. Utilize existing key senior staff in the Materials Environment Interfaces area to develop next generation leaders while maintaining unique and world class facilities at PNNL.
4. Continue to broaden the impact and participation of the Materials Research staff against the national R&D agenda.

## Environmental Technology Division

### *FY00 Issues and Actions*

1. The Division must sustain the progress of the 1st year -
  - ♦ Senior manager transition going well, ensure this is continued
  - ♦ Need to live the plan and “walk the talk” through allocation of resources
  - ♦ Must continue improving communication to the troops, reduce/eliminate clay layers, continue staff development efforts (succession planning, peer review)
  - ♦ Need to clarify public institution role vs BMI interests to diffuse tensions and smooth transitions

**Actions taken to address issue:** The Division has continued its significant efforts to put in place a stable management team, connect strategy to planning, self assessment, and staff goals, emphasize staff development, and to ensure communication (two-way) to the staff. Continued efforts are being made to address public institution vs BMI interest role, but additional effort is needed.

**Response from FY01 DRC Review Committee (selected quotes from review report):** “The DRC was pleased to find that ETD has a renewed sense of vision and purpose.” “ETD is clearly benefiting from the existence of stable management and consistent leadership at several levels of the organization.” “In general, the DRC believes that ETD is definitely delivering on the expectation that were created last year.”

2. Need the vision/plan embraced and acted upon by the staff
  - ♦ Project fit/selection must fit with vision/plan

**Actions taken to address issue:** Several specific actions were taken this past year to ensure that the Division strategy was created and communicated throughout the organization. These actions included the creation of a “Division Dashboard” that allowed routine review by the management team of critical objectives for the Division and is accessible to staff. In addition, the leadership team

communicated strategy to the staff through a variety of forums.

**Response from FY01 DRC Review Committee (selected quotes from review report):** “Compared with 1-2 years ago, it was quite evident to the DRC that a considerable amount of staff empowerment has taken hold throughout the Division, not only among senior management, but also at lower levels.”

3. The variety of roles that PNNL/ETD can play at Hanford needs to be better articulated

**Actions taken to address issue:** ETD has established key interfaces roles and clearly articulated objectives for the Hanford site with both DOE and on-site contractors. Progress is reviewed routinely and communicated.

**Response from FY2001 DRC Review Committee (selected quotes from review report):** “Last year, the DRC commented specifically on the need for ETD to seek, define, and rationalize appropriate roles for PNNL at Hanford. Consequently, we were very pleased to learn that ETD has achieved considerable success in this endeavor by becoming more deeply involved in a variety of technical efforts at the Hanford Site.”

4. New PNNL and ETD leadership needs to develop relationship with EM at various levels

**Actions taken to address issue:** ETD has been working with the “core laboratories” to develop cooperative research efforts. The initial focus is on subsurface science. In addition, PNNL plays a role on the EM S&T Senior Management Council Core Team, which is responsible for updating the EM R&D Strategy and Management plan.

**Response from FY2001 DRC Review Committee (selected quotes from review report):** “The DRC also commented last year on the need for PNNL and ETD leadership to develop a stronger and more direct relationship with DOE-EM, especially at Headquarters. This continues to be a need, as DOE-EM is a major customer of both PNNL and ETD, and there is a new administration in Washington D.C. with new senior leadership about



to be installed at DOE-EM. The DRC believes this matter must continue to receive priority attention.”

Implementation of the ETD strategy is an opportunity to pursue larger initiatives

**Actions taken to address issue:** Several large programmatic opportunities have already been realized as a result of greater focus and effort including the Bechtel Washington Contract and the Endocrine Disruptors program. The Division is pursuing additional initiatives including Bio-based products, Health Effects Research and Water Resources.

**Response from FY01 DRC Review Committee (selected quotes from review report):** Responding to the question “Do ETD’s new areas of investment emphasis make sense?”- “The answer is yes, the [initiative] area makes sense when ETD staff have done sufficient and credible homework in defining the specific market opportunity, likely, and potential customers, and most importantly of all, ETD’s comparative advantages in addressing the opportunity. Examples of areas where the DRC believes this is true include: 1. ETD’s increased role at Hanford; 2. Bio-based products, 3. Water Resources management in Mexico City; and Health effects research. The answer is no, the investment areas do not make sense when ETD staff have not done sufficient homework yet to support credibly why a certain investment area makes sense for ETD. Examples presented during the meeting where the DRC believes insufficient homework has been done include: 1. Water resources future business market and 2. New facilities needed for the Campus of the Future. While the DRC believe these areas may very well prove to be good areas for investment emphasis, a convincing case for them was not provided to us during the meeting.”

#### *FY2001 Issues*

1. Recruiting and developing (i.e., advancement) of key staff members.
2. Identifying the EM Sub-sector Lead, or re-defining the EM relationship role – particularly important because DOE-EM is ETD’s largest Customer.

3. Defining the role and future of the Sequim facility
4. Delineating the role of the DOE technical resources group in Columbus as an integral part of PNNL.

#### **Fundamental Science Division**

##### *FY2000 Issues*

1. Equipment upgrades are critical for EMSL to remain a forefront user facility. Lab should strengthen efforts in nanosciences to promote these capabilities and facilities and position the Lab for the national initiative.
  1. Significant progress has been made to increase the capital budget and the Senate has requested an additional \$7M to upgrade the EMSL computer
  2. The Nanoscience and Technology Initiative began last year and a joint institute with the University of Washington was formed on nanoscience. Given recent favorable reviews from BES, PNNL may be able to compete for a nanoscience center in FY2002.
2. Health Sciences – Clear lack of critical mass in personnel, space, and equipment in the biology area. Lab needs to focus considerable effort in this area to attract high-level researchers, especially significant laboratory renovations in 331. A strong university partner in biology would give the Lab needed recognition in this competitive area.
  1. The DRC was unanimously pleased with the progress in hiring and new funding in biology. They were particularly impressed with the lead scientist on BNI, Steve Wiley. Our challenge in FY2002 is to hire a strong project manager for BNI.
  2. A new joint institute on cell signaling has been formed with the University of Washington and negotiations are underway with Oregon Health Sciences University.
  3. Recruiting and retention of high quality staff. At higher levels in particular it is hard to compete.
    1. The progress to date has been positive. With the new division organization it will be critical

to hire prominent senior scientists to lead the new Biology and Computational Science Departments.

4. Organizational Structure of Division and how it fits in to the overall structure of the Lab. How do resources impact the Lab agenda? Fragmentation of materials research. Integration of statistics group.

1. The committee was happy with the new FSD organization and integration of statistics into the new Computational Science and Mathematics Department. The fragmentation of the materials research was a Laboratory decision that FSD cannot address.

5. Meeting Format – More interactive and longer in order to cover material sufficiently. One potential format would be to have the person in charge of the technical area being reviewed give an overview to show how everything fits together at the group or department or research focus level and brief synopses of the different projects in the group. This would be followed by a poster session where reviewers can talk and interact with specific researchers at the project level.

1. The review was changed to 2 days this year, a format that pleased the committee. None of the groups being reviewed this year were in favor of poster sessions to enhance interaction. As a result, we had too many talks.
2. The resource manager or group leader gave an overview, as suggested in last year's issues. In the future we will stick to a maximum of 3 to 4 talks per review area. This will include an overview of the group by the resource or group manager, an overview of the science by a senior scientist in the group, and one or two talks on new innovative science.

#### *FY2001 Issues*

1. The reorganization and renaming of FSD are very positive. A top priority for the Division is filling all senior level positions with superior candidates. The reorganization of computational sciences is a logical decision; however,

some concern was expressed about the separation of this group from the EMSL computational facility. This may hamper the search for a leader. PNNL is commended for the completion of the much-needed User Housing Facility and the creation of new joint institutes in global change and nanoscience. The committee was uniformly impressed with the joint global change research institute.

2. The BNI should tie tightly to the mission of DOE; there are unique opportunities here that are of national importance and for which PNNL has a unique position to lead. The committee recommends that BNI first explore systems integration at the prokaryotic level, rather than the more complex eukaryotic organisms. BNI needs some short-term deliverables and focus. Recruitment of a strong program manager for this effort is of highest priority.
3. The quality of science and people in Environmental Chemistry and Microbiology is world-class and the research could not be more relevant to DOE. It is of utmost importance to showcase this science and this group should be presented in the strongest light to DOE as a centerpiece of PNNL's program portfolio. A reduction in budget in geochemistry is unacceptable and this message should be conveyed to DOE's Office of Science.
4. Excellent presentations from the Molecular Biosciences and Toxicology group demonstrated continued progress in biology. Increased staffing and more modern facilities are essential for this effort to flourish. At a future review, FSD should address recruiting from the top tier of candidates with a coherent staffing plan.
5. The suite of tools developed by the Collaboratory staff is impressive, but the usefulness to of these tools to customers was less clear. The committee would like to hear from a set of users at the next review to better assess the impact. It is critical that at least two new DRC members are added with expertise in computational sciences.

## National Security Division

### *FY2000 Issues and Actions*

1. Continued effort on Strategic Planning
  - a. On-going implementation of the Customer Service Model (CSM)
  - b. Implementation of business thrusts through the CSM
  - c. Division "Theme"
  - d. Identification of the next major program
  - e. Managing BMI vs. PNNL business strategies

Several actions were undertaken to enhance strategic and tactical planning and implementation. NSD's product lines were consolidated (from 8 to 5) and realigned to better reflect NSD's core mission areas (Global Security, National Defense, Asset Protection, and Nuclear Science and Technology). Information sharing/exchange sessions between the product lines and the technical staff were initiated to increase staff awareness of business opportunities. The IR&D and LDRD investment strategies and funding criteria were better aligned with the Division's tactical plans. The Division's strategic and tactical planning processes were combined with the Laboratory's annual planning process to allow product lines and sectors to describe tactical actions in support of strategic objectives. To date, identification of the next major program has not been accomplished but there is an active effort within NSD to do so. Technical areas with the potential to permit initiation of a major program have been identified and are being evaluated for both technical and business potential. However, part of identifying and "winning" a major program requires high-level support both within PNNL and DOE/NNSA. Managing the interface between Battelle Memorial Institute's (BMI's) and PNNL's business strategies is proceeding.

2. Increase Visibility
  - ♦ In Washington DC with DOE/Congress
  - ♦ National level presence and improved name recognition through magazines and press releases
  - ♦ In Washington State through schools, universities

The NSD Management Team agrees with the DRC's assessment and recommendations, but recognizes building increased visibility and enhanced name recognition will be a long-term effort. Increased visibility with DOE/Congress requires an active, ongoing effort by PNNL's and NSD's Directors and senior staff in NSD, and Battelle's Congressional Relations Director and staff. A proactive outreach communications effort has been emphasized and is demonstrating positive results in obtaining national-level recognition for NSD's accomplishments. NSD also has committed to encourage broader participation in PNNL's university relations program to help increase faculty and student interactions with PNNL/NSD staff.

3. Recruiting and retaining staff, particularly in information technology through
  - a. Project Opportunities
  - b. Staff involvement in strategic planning and other activities
  - c. New staff member orientation

Analysis of NSD staff input to the Laboratory 1999 Quality of Work Life survey provided additional information for enhancing staff development and participation in NSD business and actions. Additional information was added to NSD's internal homepage; staff can learn about NSD's business strategy and emerging and existing areas of work, as well as post areas of expertise in a Project Opportunities and Work Wanted Site. Staff members have been involved in the strategic planning process, Product Line Managers are now involved in Technical Group meetings and activities, and a staff orientation process was implemented for new staff that covers relevant NSD processes, projects, requirements, and career development.

### *FY2001 Issues*

- ♦ Create PNNL's/NSD's niche in NNSA, i.e. create recognition that an Office of Science Laboratory can/should be an active participant in NNSA's national security responsibilities.
- ♦ Work with the Laboratory Director's office to enhance NSD's visibility within PNNL and the DOE/NNSA

- ♦ Determine validity of performing a market analysis of critical NSD business.

NSD is currently addressing these recommendations and will recommend and implement actions

for each of the DRC's recommendations as part of our strategic and tactical planning and implementation. To date (August 2001), no specific actions have been finalized.



# **Appendix B**

**Summary of Operational Improvement Initiatives  
for FY2001**



## Summary of Operational Improvement Initiatives for FY2001

The FY2001 Operational Improvement Initiatives (OII) have moved us closer to one of our strategic objectives: to become a leader in research management and operations. We strive to create an integrated set of management systems that facilitate and enable effective research and technical interaction by providing staff with useful, cost-effective, and “hassle-free” work processes.

The FY2001 Initiatives were developed as an integral part of the Laboratory’s planning and assessment processes. The initiatives were selected and approved by the Laboratory Leadership Team based on their potential impact on Laboratory objectives and performance.

### Hazards Analysis Initiative (HAI)

**Accomplishments:** The key principle of integrated hazard analysis process at PNNL includes the integration of Electronic Prep & Risk (EPR), the Project Contracts Information System (PCIS), Integrated Operations System (IOPS), and the Standards Based Management System (SBMS). An independent review of the technical approach was performed and the concept was validated. Recommendations from that review were incorporated into the refined concept. A standardized set of Hazard Groups and Elements was developed and approved, and will be maintained in the SBMS Requirements Management Module. PNNL tools related to hazard identification, analysis, and mitigation will use the standard set of Hazard Groups and Elements to communicate information about hazards and mitigation between the tools. SBMS Subject Areas and IOPS hazard definitions have been mapped to the Hazard Groups and Elements (Management System approval of the mapping is in progress). The concept was piloted on a diverse set of 14 existing R&D projects to validate the approach and assess the value of the proposed changes to stakeholders. The pilot validated the approach, produced further refinements to the concept, and confirmed the positive value that stakeholders would be expected to realize. The

path forward for FY2002 was planned and the FY2002 Hazard Analysis OII was approved.

### Impact/Benefits

#### ♦ Impact/Benefits to R&D staff:

- More efficient and effective project planning.
- Consistent/efficient/effective communication between stakeholders associated with R&D projects.
- Supports IOPS Core Principles:
  - ❖ Flexibility based on Accountability – *Focuses information and communication on accountable roles of project manager and cognizant space manager*
  - ❖ Enabling vs Controlling Environments – *Provides useful information for hazard control decision-making*
  - ❖ Consensus Based Work Practices – *Emphasizes use of existing benchtop controls developed by users*

#### ♦ Impact on cost reduction or avoidance:

- Reduced cost for project planning through increased efficiency and effectiveness
  - ❖ Identification of requirements (SBMS & IOPS)
  - ❖ Preparation of required project planning documentation
  - ❖ Assurance that all relevant requirements are addressed
- Reduced cost responding to incidents
  - ❖ Reduction of incidents
  - ❖ Better information about what project planning was actually performed.

#### ♦ Impact on reduced risk/increased compliance:

- Requirements more fully and efficiently met
  - ❖ Project plans will address all relevant requirements
  - ❖ Safety (worker/public/facility) will be increased

- ❖ Risk of incidents will be reduced
- ❖ Compliance will increase

- ◆ **Impact on Intellectual Property, other national labs, and Battelle**

- Integration improves the marketability and IP value of the suite of ES&H/Operations tools that PNNL has been developing: Standards-Based Management System, Integrated Operations System, Chemical Management System, and the Map Information Tool.
- Increased potential to help other national labs exists as they improve their operations by adopting the integrated suite of operational tools developed and proven at PNNL

## **Drawing the Roadmap to Second Generation Management Systems**

**Accomplishments:** The Second-Generation Management System Initiative was established to clearly understand the operational issues that are making it more difficult for staff working at Pacific Northwest National Laboratory to complete research and development (R&D) activities. The assumption was that the cure to all of our problems was somehow grounded in the fact that management systems owners were not doing an adequate job of understanding and meeting the needs (providing better tools and services at significantly lower costs) of the R&D staff. Hence, primary expectations of the initiative were to 1) develop and pilot tools to measure the maturity of individual management systems and the overall maturity of the management systems approach to operating PNNL, and 2) define the second-generation design objectives that would improve the delivery of supporting processes, tools, and services that R&D staff perceive to be user friendly and better enable them to perform research.

During FY2001, this initiative:

- ◆ Developed and deployed a management system maturity evaluation tool to allow all management systems to evaluate their self-assessment results using a common framework, and to allow PNNL senior managers to evaluate the management system as a whole
- ◆ Critically reviewed existing first generation management system concepts and benchmarked those concepts with Brookhaven National Laboratory's (BNL) SBMS to identify improvements that can be incorporated into the PNNL management system
- ◆ Updated the SBMS management system design criteria to provide a more comprehensive framework for delivery mechanisms such as standing committees, subject matter experts (SMEs) (for those systems where the content is sufficiently specialized that SMEs are appropriate to efficiently deliver services), training, and electronic tools
- ◆ Completed the process mapping of the Customer Service Model (CSM) components by asking those involved to describe the process so we could identify interfaces between the CSM and management systems to provide better definition of customer needs for management systems
- ◆ Identified the most pressing issues inhibiting the effective execution of expert delivery (from the product line managers' point-of-view)
- ◆ Began to use the expert delivery process flow to redesign supporting management systems
- ◆ Developed a risk/value evaluation tool for management systems

The analysis phase of the OII, confirmed that the way we articulate, implement, and manage **both** the Customer Service Model and management systems drives the effectiveness and efficiency of the Laboratory's R&D work environment. The CSM (the way PNNL runs the business of performing research and development) and management systems (the way PNNL runs the business of operating a national laboratory) provide an interconnected framework such that weakness in the implementation of either limits the effectiveness/efficiency of the other. In addition to the management systems-related improvements the FY2001 OII effort identified the fact that critical improvements in PNNL's implementation of the CSM are central to improving the working environment for R&D staff.

The OII effort produced the following conclusions and recommendations:

With respect to management systems we concluded that:

- ♦ PNNL's first generation management system concepts were generally sound and require only fine-tuning, such as consolidating some systems
- ♦ We do not need to start over with a revolutionary redevelopment of our management systems. The path to "second generation management systems" will generally involve the work of maturing existing systems and making a few targeted improvements in both systems and delivery mechanisms.
- ♦ The Management System Maturity Evaluation indicates that as a "total system" the most fertile ground for improvement relates to the self-assessment approaches employed by the management systems. We need to mature the self-assessment approaches to provide the necessary information to evaluate the corporate implications of system implementation and performance.
- ♦ Approximately two-thirds of the management systems are sufficiently mature to begin focusing on their processes (e.g. managing the quality of process inputs, identifying internal control points, and refining procedures & requirements) that will provide the information needed to identify opportunities for improving system efficiency.
- ♦ Several systems either significantly cross-cut/integrate functions of other management systems or carry out virtually all of their functions through other management systems (e.g. Quality, Project Management, and Integrated ES&H management systems). The appropriate system stewards should explore other alternative delivery strategies such as documenting the information as program descriptions, that are the product of an integrating management system or grouping them into a consolidated management system.

With respect to the Customer Service Model we determined that:

- ♦ Most of the implementation issues with the expert delivery process identified by product line managers were in deployment of the Customer Service Model and not with the level of support received from management systems. Initial indications from Capability Stewards and Relationship Managers mirror these results.
- ♦ Even though the fundamental structure of Expert Delivery is the same for all product lines, the process implementation, expectations and delivery mechanisms are left to the discretion of individual product line managers, sometimes project managers.
- ♦ The maturity evaluation of the CSM indicated that the CSM is not being managed with the same discipline as our management system processes. To ensure sustained improvements we need to formally manage the Customer Service Model with the same rigor and discipline that we expect of our management systems.

#### Impact/Benefits

- ♦ **Impact on reduced risk/increased compliance:** The project identified needed upgrades to the Lab's system-wide self-assessment program to provide the information needed to better understand implementation status and evaluate the implications of such at the Lab level.
- ♦ **Impact on other national labs and Battelle:** The project established a path forward for improving the performance of management systems, but more importantly identified critical implementation issues associated with the Customer Service Model that are at the root of R&D staff issues, and that limit the ability of management system owners to improve the efficiency and effectiveness of their processes.

The evaluation tools and conclusions derived from this initiative will be shared with management system staff from BNL, ORNL, NREL, and INEEL.

## Electrical Safety Self-Assessment

**Accomplishments:** This initiative conducted a third party self-assessment of the PNNL Electrical Safety Program.

### Impact/Benefits

- ♦ **Impact/Benefits to R&D staff:** The assessment identified areas to be investigated within R&D to potentially improve its collective electrical safety.
- ♦ **Impact on reduced risk/increased compliance:** This project verified our compliance with national electrical safety standards and processes.
- ♦ **Impact on other national labs and Battelle:** The results of this assessment indicate that PNNL has an electrical safety program that others in the industry should benchmark.

## Proposal Pricing System

**Accomplishments:** This initiative established a Proposal Pricing System core team to analyze improvement opportunities, establish an initial concept system and define system requirements. We established a users group consisting of more than 30 cost sheet users from across the lab. Meetings were held to present the initial system concept and gather feedback on system requirements. A system requirements document was developed and we identified an IT resource to complete the system design and budget, and to build the system in FY2002.

### Impact/Benefits

- ♦ **Impact on cost reduction or avoidance:** The current method for preparing cost sheets is not integrated with financial information or the project management planning system. When completed, the new system will allow information that now has to be retrieved by hand from other systems to be imported into a web-based cost sheet. In addition, the new system will have a seamless link with the project management system that will allow resource information contained in project plans to be downloaded into a cost sheet. This will eliminate the cumbersome balancing of the two systems that currently takes place. These improvements will make cost sheets easier and less time consuming to prepare. In addition to cost savings, it is anticipated that

strategic and manpower planning will be enhanced by the creation of a proposal-pricing database. Currently, cost sheets exist as individual Excel files that are located across the Lab on the hard drives of the administrators and financial specialists who create them. By having the data located in a database on a networked server, anyone with data querying skills will be able to manipulate the data in aggregate.

## Replacement of the ACES system

**Accomplishments:** This initiative replaced the Access Control Entry System (ACES) with an Automated Radiological Access Control System (ARACS) to control work performed under a Radiological Work Permit (RWP) at PNNL.

### Impact/Benefits

- ♦ **Impact/Benefits to R&D staff:** ARACS will benefit the R&D staff by allowing staff members to perform their own access control. The old system required manual input by a station operator before staff could proceed with radiological work. This caused time delays and lost productivity. The ARACS system is available 24 hours a day, seven days a week. During the log in process, individuals will be informed of their whole body dose status and any training or bioassays that will be due within 30 days. The link between IOPS and ARACS will allow workers to view RWPs in a .pdf format. RWPs can be viewed in two modes, the first from the IOPS front page, which will allow the user to view RWPs for any facility; the second, when viewing a hazard analysis for a specific room. The RWP also has links to the procedures associated with RWP.
- ♦ **Impact on cost reduction or avoidance:** Estimated annual savings for PNNL from ARACS is \$224,235. The hard savings will come from the money spent to operate the ACES stations (\$142,835) and the annual ACES user fee of \$40,000. Other potential savings will come from access processing time (\$30,000), and RWP development time \$47,400. The current annual cost to operate ARACS is \$24,000 for the maintenance contract and \$12,000 in administrative costs.



- ♦ **Impact on reduced risk/increased compliance:** With the implementation of ARACS, all radiological work now requires access control. This will reduce the risk of personnel working in areas for which they do not have proper training or bioassays. A real time interface that connects ARACS and Hanford's Radiological EXposure System, REX. This interface enhances the ability to determine if an individual is on the proper schedule with the proper type of bioassay
- ♦ **Impact on other national labs and Battelle:** PNNL is the first national laboratory to implement the ARACS system. Since the purchase of ARACS by PNNL, Savannah River National Laboratory and Bechtel-Hanford have also purchased the system.

### Institutionalize the Integrated Operations System (IOPS)

**Accomplishments:** During FY2001, this initiative successfully implemented the IOPS hazards identification and communication tool in the 326 and 329 buildings, and tailored its features to fit the specific needs of these facilities. In addition, IOPS was rolled out to the EESB, 323, and 3730 buildings, all within the existing budget.

Specific deliverables completed in FY2001 include the

- ♦ Implementation of the Cognizant Space Manager (CSM) concept in the facilities through training on roles, responsibilities, authorities, and accountabilities. CSMs were assigned spaces and then instructed and mentored on the use of the IOPS tool.
- ♦ Development and implementation of existing IOPS work practices were tailored to meet the needs of the 326 (including 323 and 3730) and 329 facilities.
- ♦ Development of Laboratory Handbooks for each space in the facilities (not applicable to EESB).
- ♦ Completion of self-assessments of each laboratory space to address necessary permitting, hazard awareness and identification, and safe operating processes and procedures. Self-assessments conducted in EESB by National Security Division staff will address security risks.

- ♦ Introduction of IOPS into EESB to address safeguards and security "risks," including necessary program changes to comply with Operations Security requirements.

### Impact/Benefits

- ♦ **Impact/Benefits to R&D staff:** Staff are using the IOPS tools to meet their responsibilities and accountabilities for the safe conduct of work. The tools provide a single source for information and instructions related to workspace hazard interactions and mitigation requirements. Staff are experiencing improved communication through system e-mails, Hazard Awareness Summaries, Lab Handbook Work Practices, and training matrices. Confusion about workspace access authorization and hazard interaction is minimized. Staff assigned the role of Cognizant Space Manager now have "ownership" of their workspace to manage and assure safe operations.
- ♦ **Impact on reduced risk/increased compliance:** This initiative is integral to the Laboratory's Integrated Environment, Safety & Health Management system. It contributes directly to the Voluntary Protection Program and is being utilized by the Integrated Safeguards and Security Program. IOPS greatly simplifies the identification of hazards in workspaces and communication to staff interacting with those hazards. Delivery of SBMS requirements to the bench top is enhanced through the development of facility-specific practices owned by the facility safety committees. The imbedded self-assessment process assists in monitoring compliance in workspaces.
- ♦ **Impact on other national labs and Battelle:** Interest in the IOPS concept and tool continues to be expressed by DOE and other national laboratories.

### EJTA/IOPS/SDTP Improvement and Integration OII

**Accomplishments:** This initiative resulted in the successful replacement of a web-based job evaluation and training requirement identification application.



## Impact/Benefits

- ♦ **Impact/Benefits to R&D staff:** The major impact to R&D staff will be from streamlining the operation of the training-planning tool and for providing Notices of Change that require reviewing the approved plan, thus keeping the training plans current. The enhancements also provide greater flexibility and ease of use for Training Coordinators.
- ♦ **Impact on cost reduction or avoidance:** Financial savings will result primarily in “soft savings” by eliminating duplication of effort. Implementing the workflow concept and simplifying and accelerating the process will significantly reduce the overall time spent by staff, training coordinators, and managers in identifying, approving, and tracking training requirements. Cost savings estimates are difficult to quantify, especially since the labor cost avoidance will most likely be applied to other overhead tasks and project work. The new Job Evaluation Training System (JETS) tool provides for updating the training plan as changes become evident via IOPS or training taken. Previously, Staff Development & Training Plans (SDTP) were developed and approved annually. JETS will result in better maintenance of training plans at the cost of additional reviews during the year for some staff.
- ♦ **Impact on reduced risk / increased compliance:** JETS will result in improved integration with IOPS. In addition, the more up-to-date training plans should provide a higher level of assurance that training requirements are being identified.
- ♦ **Impact on Intellectual Property:** The JETS application is copyright protected under PNNL’s 1830 contract. It is possible that, like the earlier SDTP application, JETS could be adopted by the Hanford PHMC and PNNL support could be provided for revising and implementing JETS at Hanford.
- ♦ **Impact on other national labs and Battelle:** The JETS application has broad applicability at

both DOE R&D Labs and Battelle Memorial Institute (BMI). It could be adapted and/or provided to other DOE R&D Labs and BMI as a tool to manage training requirements. Past history however, has demonstrated that the likelihood of this happening beyond the confines of the Hanford site is unlikely.

## 21st Century Facility Design Concepts

**Accomplishments:** This initiative developed concepts for integrating sustainable technologies into PNNL’s new Vision 2010. Sustainable concepts were identified and evaluated which could be used to develop a master site plan, as well as individual facility designs. The results of this effort will be discussed with the PNNL Leadership Team and DOE-RL to determine how a sustainable campus design might be used to deliver on the Laboratory’s strategic objectives, for current and future missions.

## Impact/Benefits

- ♦ **Impact/Benefits to R&D staff:** Sustainable concepts are intended to assist staff to meet their short and long-term facility needs. The use of sustainable technologies also provides research staff the ability to demonstrate their research capabilities. The goal is to get staff involved, owning this vision, and feeling that they are valued and have a voice in the future of the Laboratory.
- ♦ **Impact on cost reduction or avoidance:** Implementation of a well thought out master plan will help reduce long-term operational costs and increase staff productivity.
- ♦ **Impact on reduced risk/increased compliance:** Risk to successful, cost-conscious operation of PNNL facilities will be reduced if we minimize our reliance on conventional energy sources. This sustainable concept will increase the reliability and quality of our energy.
- ♦ **Impact on Intellectual Property:** The use of sustainable concepts may assist related business development activities with commercialization of sustainable technologies.

♦ **Impact on other national labs and Battelle:**

In the process of developing these concepts, we have a greater understanding of how other Battelle-managed labs are planning facility growth. This effort has also provided opportunities to share sustainable design concepts with other DOE national laboratories and other federal facilities.

**LAI Consolidation and Lab Initiative Moves**

**Accomplishments:** This initiative established a Local Area Island (LAI) in EESB, leased an existing office building, and moved 435 staff.

**Impact/Benefits**

- ♦ **Impact/Benefits to R&D staff:** Establishment of this LAI reduced the risk of compromise and provided additional space necessary to expand the NSD mission. Strategic moves created growth space to accommodate R&D staff and allowed greater alignment of staff with facility profiles and capabilities.
- ♦ **Impact on reduced risk/increased compliance:** The creation of this LAI allowed the Lab to expand NSD work and ensure compliance with Safeguards and Security regulations and requirements.



## **Appendix C**

**DOE-RL's Satisfaction with the Implementation  
of Self-Assessment Processes at PNNL in FY2001**

# DOE-RL's Satisfaction with the Implementation of Self-Assessment Processes at PNNL in FY2001

## Summary

For the last several years, the Laboratory's annual self-evaluation has included an evaluation of DOE RL's satisfaction with PNNL's Integrated Assessment performance measurement systems. Key areas addressed in this annual survey have been RL's satisfaction with 1) the level of their involvement in PNNL's self-assessment processes; and 2) to what degree their PNNL counterparts use self-assessment results to drive performance improvement. The respondents' level of understanding of self-assessment processes was also measured.

Based on input from a team of RL staff, the FY2001 survey increased the emphasis on relationship building, evaluating the strengths of the relationship between RL staff and their PNNL self-assessment counterparts, and improving the relationship through alignment of expectations. This bilateral approach to refining the survey instrument was in direct response to suggestions made during the FY2000 survey.

The survey was conducted during May and June 2001. The survey population was considerably larger than in previous years (see Table C.1) in an attempt to capture all available input and increase the validity of the overall survey results. Seventy-five surveys were distributed electronically and sixty-nine surveys were returned, resulting in the highest response rate to date (92%) and a 10% increase over FY2000. Survey results, including ratings and unedited comments from each counterpart, have been shared with each respective PNNL counterpart to facilitate a dialogue that will bring relationship strengths to the surface and identify any areas where some fine-tuning might be needed.

We believe that the *dialogue* between RL and PNNL counterparts that results from the collection, analysis and *sharing* of survey data is significantly more important to relationship-building and understanding self-assessment, and hence, to increased satisfaction with the implementation of the pro-

cesses, than annual fluctuations in scoring levels. These fluctuations can be the product of numerous influences other than increases or decreases in satisfaction. For example, we believe the data described herein is affected by the length of time that RL counterparts have been in their respective positions.

## Analysis

Overall, the FY2001 survey results are positive. Table C.1 provides a detailed summary of key metric comparisons between FY2000 and FY2001. Figures C.1 through C.3 provide graphic comparisons. No chart was prepared to show the trend for alignment because there is virtually no change between FY2000 and FY2001 results.

As can be seen in Figure C.1, the number of respondents rating their level of satisfaction as "excellent" or "outstanding" remained fairly constant while a significant number of "good" responses, and one "unsatisfactory" response, were received. When the increase in the number of respondents to this year's survey is considered, the percentage of "excellent" responses actually dropped. The "outstanding" responses remained roughly constant (12% in FY2000 to 11% in FY2001), while "excellent" responses dropped from 56% in FY2000 to 35% this year. Investigation into the number of "good" responses, however, indicates that they are primarily the responses of RL staff who are new to the self-assessment counterpart role. Fully 20% of the RL staff surveyed had been in their respective roles less than one year, many for less than 6 months. We believe their responses reflect their newness with the program and its processes. In addition, this would seem to suggest that some expectations are not being met, centering around the *type or nature* of interactions that are occurring between RL and PNNL counterparts. Looking at the type of activities each counterpart wants to be involved in (e.g., assessment planning, reviewing results, etc.)

Table C.1. Overall Summary of Results DOE-RL Satisfaction Survey FY1998 - FY2001

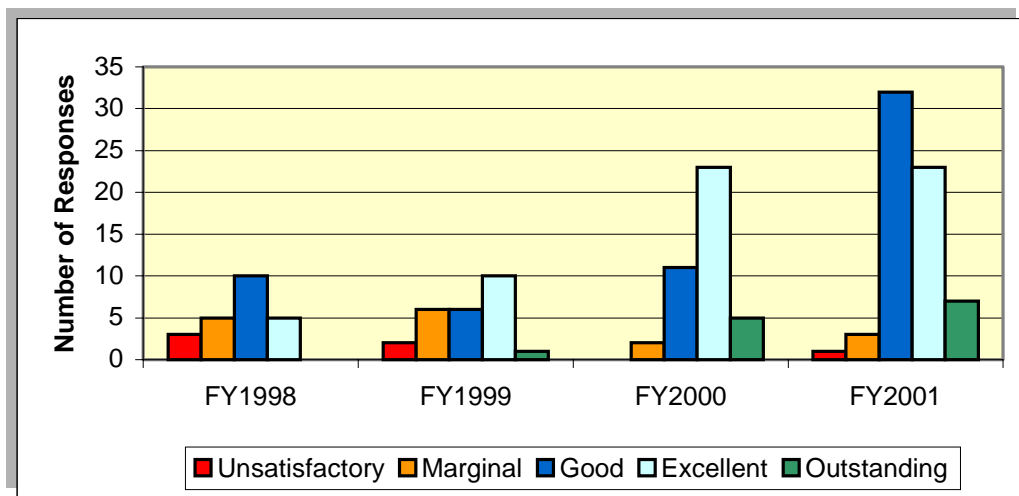
Area	FY1998	FY1999	FY2000	FY2001
Survey population		31	55	75
Survey response rate	43%	81%	82%	92%
DOE-RL satisfaction with overall level of involvement in PNNL's self-assessment processes	Satisfied or better Target: Positive trend Result: 88%	Satisfied or better Target: Positive trend Result: 87%	Satisfied or better Target: Positive trend Result: 93%	Satisfied or better Target: Positive trend Result: 83%
DOE-RL satisfaction with PNNL's use of assessment results to drive improvement	Satisfied or better Target: 90% Result: 77%	Satisfied or better Target: 90% Result: 91%	Satisfied or better** Target: 91% Result: 100% Rating: Outstanding	Satisfied or better** Target: Maintain Result: 94% Rating: Excellent
DOE-RL evaluation of degree of alignment between counterpart's self-assessment performance measures and the Laboratory's strategic goals			Excellent to Outstanding Target: Baseline Result: 90%	Excellent to Outstanding Target: 90%+ Result: 89%
DOE-RL evaluation of maturity and effectiveness of their counterpart's self-assessment process				Target: Baseline Results: Improved 57% No change: 32% No response*: 12%
DOE-RL level of understanding of self-assessment processes	Adequate or better Target: Baseline Result: 88%	Good or better Target: Positive trend Result: 91%	Good or better Target: Positive trend Result: 94%	Good or better Target: Positive trend Result: 97%
DOE-RL level of interest in receiving training related to self-assessment and business planning			% Interested Target: Baseline Result: Planning: 92% SA: 58% Int Assmnt: NA	% Interested Target: Positive trend Result: Planning: 46% SA: 12% Int Assmnt: 27%
% of DOE-RL counterparts in their role for less than one year				20%
<p>* = "No responses" were from RL counterparts who had been in their role for less than one year and preferred not to comment.</p> <p>Shaded areas indicate that an item was not included as part of the survey for the year.</p> <p>** In FY2000, a new metric was applied to measuring the use of self-assessment results to drive improvement: 75% rating 4 or higher = Outstanding. 90% rating 3 or higher = Excellent. Using this metric, the Lab achieved an overall rating of Outstanding in this area by achieving 85% rating 4 or higher. Using this same metric in FY2001, the Lab achieved an overall rating of Excellent, achieving 94% rating 3 or higher. Of concern is that only 46% of the respondents gave a rating 4 or higher in this area. However, the "Satisfied or better" measure is used in table above for FY2000 and FY2001 to allow an equal comparison across the years FY1998 to FY2001.</p>				

and comparing this result with the interactions that have occurred over the past year, might be revealing. Providing PNNL counterparts with survey results should facilitate this effort and lead to a positive resolution of this situation.

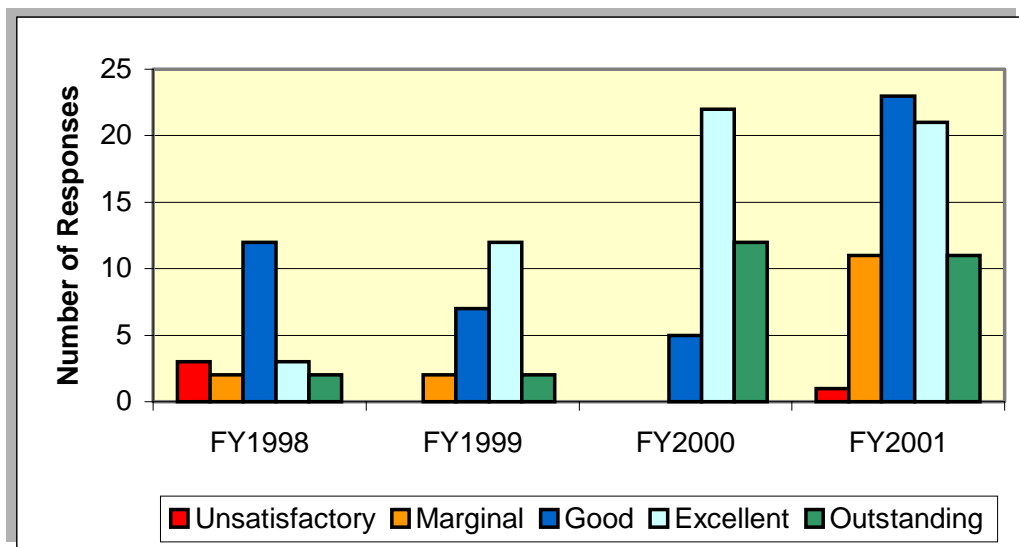
Figure C.1 provides a similar distribution of responses to the RL Satisfaction Survey, with one exception. When the increased number of respon-

dents to this year's survey is considered, the overall percentage of "outstanding" and "excellent" responses actually dropped. The "outstanding" responses dropped from 31% in FY2000 to 16% in FY2001 (a 53% decrease) while "excellent" responses dropped from 56% in FY2000 to 35% this year. Investigation into the number of "good" responses however, indicates that they are the primarily the responses of new RL staff.





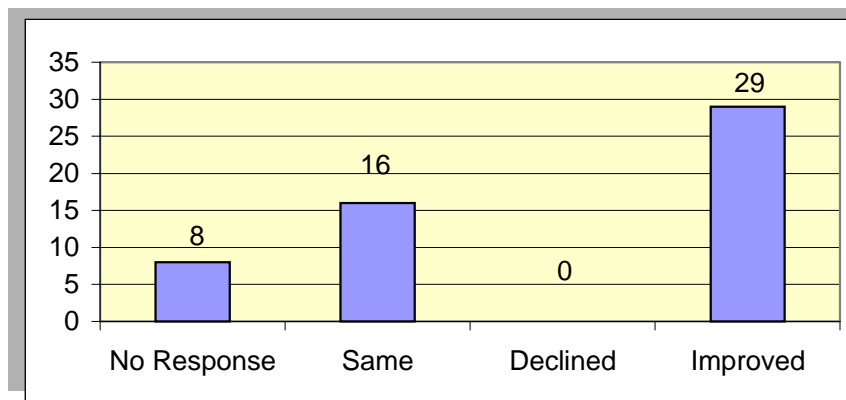
**Figure C.1.** DOE-RL's Satisfaction with Frequency of Interactions and Their Overall Level of Involvement in Self-Assessment Activities



**Figure C.2.** DOE-RL's Satisfaction with PNNL's Use of Assessment Results to Affect Improvement

There may be a correlation between the respondents' drop in satisfaction with involvement in self-assessment activities and the opportunities for RL counterparts to witness or be aware of results being used to drive improvement. Lack of understanding of self-assessment concepts and processes does not appear to be a factor, with a slight (3%) increase over FY2000 results. This is an area that warrants attention.

As shown in Figure C.3, there were no negative responses (i.e., "Declined") relative to self-assessment process maturity. It might be argued that "no change" (i.e., "Same") in the level of maturity could be interpreted as a less than positive condition. An equally valid point of view, however, is that this is an indication of the plateaus that are necessary if processes are to maintain stability as they go



**Figure C.3.** Level of Maturity of Battelle Counterpart's Self-Assessment Process

through trial and error periods essential to the development of an effective performance measurement system. Note that this is a new survey item.

### Summary of Comments from DOE-RL Survey Respondents

In all, thirty-four (49%) of DOE-RL survey respondents provided comments. This represents an increase of 11 percentage points over last year. Of these, only one could be described as negative, stating that there had been no meetings the entire year with the PNNL counterpart. Six comments were in the “neutral” category, correlating their lack of close connections with their PNNL counterparts with their recent acquisition of the counterpart role.

The majority of comments, twenty-seven in all, were positive. “Good to work with” and “good communicator” were the most frequently stated comments, followed by dedication, strong partnering skills, and the use of good metrics. In many cases, the tone of the comments was not simply polite, but openly enthusiastic. This may be the strongest indicator of all that many relationships have been strengthened over the past year.

Throughout FY2002, we will work with our RL counterparts to refine our survey instrument so that it continues to provide us with the information we need to support and enhance the relationship building that is so important to the Integrated Assessment Program's effectiveness.



# **Appendix D**

## **Acronyms**

## Appendix D — Acronyms

ACES	Access Control Entry System
ALARA	As Low As Reasonably Achievable
AMT	Associate Manager for Science and Technology
ANSTI	Advanced Nuclear Science and Technology Initiative
AoA	Alliance of Angels
APEL	Applied Processing Engineering Laboratory
ARACS	Automated Radiological Access Control System
ARM	Atmospheric Radiation Monitoring program
ARSA	Automated Radioxenon Sampler/analyzer
ASTM	American Society for Testing and Materials
ATS	Assessment Tracking System
BASR	Biotechnology Association of the Spokane Region
BER	US Department of Energy, Office of Biological and Environmental Research
BES	US Department of Energy, Office of Basic Energy Science
BFA	Building Fire Appraisal
BMI	Battelle Memorial Institute
BNI	Biomolecular Networks Initiative
BNL	Brookhaven National Laboratory
C3T	Cleanup Constraints and Challenges Team
CAM	Continuous Air Monitor
CAMS	Corrective Action Management System
CCI	Community College Institute
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation and Liabilities Act
CHG	CH2Hill Hanford Group
CI	Counterintelligence
CIIT	Chemical Industry Institute for Toxicology
CN	U.S. Department of Energy, Office of Counterintelligence
CRADA	Cooperative Research and Development Agreement
CS&I	Computer Science and Information Technology technical network
CSI	Cell Systems Institute
CSI	Computational Sciences and Engineering Initiative
CSiTE	Terrestrial Carbon Sequestration Center
CSM	Customer Service Model
CSM	Cognizant Space Manager
CTBT	Comprehensive Test Ban Treaty
D&D	Decontamination and Decommissioning
DNA	Deoxyribose Nucleic Acid
DOE	U.S. Department of Energy
DOE-CN	U.S. Department of Energy, Office of Counterintelligence
DOE-EE/RE	U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy
DOE-FE	U.S. Department of Energy, Office of Fossil Energy
DOE-EM	U.S. Department of Energy, Office of Environmental Management
DOE-IN	U.S. Department of Energy, Office of Intelligence

DOE-NN	U.S. Department of Energy, Office of Nonproliferation and National Security
DOE-RL	U.S. Department of Energy, Richland Operations
DOE-SC	U.S. Department of Energy, Office of Science
DRC	Division Review Committee
EDO	Economic Development Office
EJTA	Employee Job Task Analysis
EMSL	Environmental Molecular Sciences Center
EMSP	Environmental Management Science Program
EPA	U.S. Environmental Protection Agency
EPR	Electronic Preparation & Risk process
EQ	Environmental Quality
ERULF	Energy Research Undergraduate Laboratory Fellowship
ES&H	Environment, Safety and Health
ESIF	Early Stage Investor Forum
ESTD	Energy Science and Technology Division
ETD	Environmental Technology Division
F&O	Facilities and Operations Directorate
FaST	Faculty and Student Team
FAST	Federal And State Technology program
FEMP	Federal Energy Management Program
FIE	Field Intelligence Element
FLC	Federal Laboratory Consortium
FTE	Full Time Equivalent
FSD	Fundamental Sciences Division
FSR	Field Service Representative
GIRM	Graphite Isotope Ratio Method
GTL	Genomes to Life program
HAI	Hazard Analysis Initiative
HTWU	Hazardous Waste Treatment Unit
IA	Internal Audit
IC	Intelligence Community
IN	U.S. Department of Energy, Office of Intelligence
INEEL	Idaho National Engineering and Environmental Laboratory ????????
INSP	International Nuclear Safety Program
IO	Independent Oversight
IOPS	Integrated Operations system
IPEP	Integrated Project Expert Panel
IR&D	Independent Research and Development
ISI	Institute for Scientific Information
ISM	Integrated Safety Management
ISSM	Integrated Safeguards and Security Management system
IT	Information Technology
JETS	Job Evaluation Training System



LAI	Local Area Island
LDRD	Laboratory Directed Research and Development
LRC	Laboratory Review Committee
LWR	Light-Water Reactor
MCDF	Microbial Cell Dynamics Facility
MIT	Massachusetts Institute of Technology
MSCF	Molecular Sciences Computing Facility
MSO	Management System Owner
MYPP	Multi-Year Program Plan
NABIR	Natural and Accelerated Bioremediation
NATT	Northwest Alliance for Transportation Technology
NCI	National Cancer Institute
NEPA	National Environmental Policy Act
NERSC	National Energy Research Scientific Computing Center
NETL	National Energy Technology Laboratory
NBR	National Bureau of Asian Research
NERI	Nuclear Energy Research Initiative
NIEHS	National Institute for Environmental Health Sciences
NIGMS	National Institute for General Medical Sciences
NIH	National Institutes of Health
NMR	Nuclear Magnetic Resonance
NN	U.S. Department of Energy, Office of Defense Nuclear Nonproliferation
NNI	Nanoscience and Nanotechnology Initiative
NNSA	National Nuclear Security Administration
NOAA	National Oceanographic and Atmospheric Administration
NREL	National Renewable Energy Laboratory
NSD	National Security Division
OBER	U.S. Department of Energy, Office of Biological and Environmental Research
OCI	U.S. Department of Energy, Office of Counterintelligence
OHSU	Oregon Health Sciences University
OHVT	U.S. Department of Energy, Office of Heavy Vehicle Technology
OII	Operational Improvement Initiative
ONNSI	Office of Nuclear and National Security Information
ORNL	Oak Ridge National Laboratory
ORP	Office of River Protection
OSHA	Occupational Safety and Health Administration
OSTI	Office of Scientific and Technical Information
OTT	U.S. Department of Energy, Office of Transportation Technology
PAAA	Price Anderson Amendments Act of 1988
PALS	Partnership for Arid Lands Stewardship
PCIS	Project Contracts Information System
PE&FA	Performance Evaluation and Fee Agreement
PEM	Proton Exchange Membrane
PFP	Plutonium Finishing Plant
PHMC	Project Hanford Management Contract
PNNL	Pacific Northwest National Laboratory

PNW	Pacific Northwest
PNWCGS	Pacific Northwest Center for Global Security
PST	Pre-Service Teachers Programs
PU	Light weight trucks (pick-ups)
R&D	Research and Development
R2A2	Roles, Responsibilities, Accountabilities and Authorities
RASA	Radionuclide Aerosol Sampler/analyzer
REX	Radiological Exposure System
RFP	Request for Proposal
RWP	Radiological Work Permit
S&S	Safeguards and Security
S&T	Science and Technology
SAC	System Assessment Capability
SAS	Safeguards and Security
SBIR	Small Business Innovation Research
SBMS	Standards Based Management System
SCIF	Sensitive Compartmentalized Information Facility
SDTP	Staff Development & Training Planning
SECA	Solid-State Energy Conversion Alliance
SME	Subject Matter Expert
SMIT	Safety Management Implementation Team
SOFC	Solid Oxide Fuel Cell
SPP	Savannah River Site Salt Processing Project
SRAP	Student Teacher Apprenticeship Program
SRTC	Savannah River Technology Center
SST	Scientist-Student-Teacher High School Research Program
SUV	Sort Utility Vehicle
T&Q	Training and Qualification
TAP	Technical Assessment Panel
TFA	Tanks Focus Area
TIC	Technical Integration Center
TRIDEC	Tri-City Industrial Development Council
TRP	Teachers Research Program
TRU	Transuranic. Usually refers to Transuranic Wastes
UCSD	University of California, San Diego
UW, U of W	University of Washington
UW/CSI	University of Washington, Cell Systems Institute
U.S.	United States
VPP	Voluntary Protection Program
VRT	Virtual Respiratory Tract
WFO	Work For Others
WGI	Washington Group International
WISHA	Washington (State) Industrial Safety and Health Act
WRISRC	Western Regional Information Science Research Center
WSU-TC	Washington State University, Tri-Cities