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Pacific Northwest National Laboratory

FY96 Annual Self-Evaluation Report

October 1996

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest National Laboratory
Operated for the U.S. Department of Energy
by Battelle

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PACIFIC NORTHWEST NATIONAL LABORATORY

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for the

UNITED STATES DEPARTMENT OF ENERGY

under Contract DE-AC06-76RLO 1830

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FY96 ANNUAL SELF-EVALUATION REPORT
For
THE PACIFIC NORTHWEST NATIONAL LABORATORY

This document directly supports the Pacific Northwest National Laboratory
Contract DE-AC06-76RL01830, Appendix F.

October 21, 1996

TYPE ANNUAL SELF-EVALUATION REPORT

For

THE PACIFIC NORTHWEST NATIONAL LABORATORY

This document describes the Pacific Northwest National Laboratory
Contract DE-AC05-78B01830, Appendix 1

October 21, 1979

Executive Summary

Pacific Northwest National Laboratory (PNNL) research and development efforts are concentrated on DOE's environmental quality mission and the scientific research required to support that mission. The Laboratory also supports the energy resources and national security missions in areas where an overlap between our core competencies and DOE's goals exists. Fiscal year 1996 saw the Laboratory focus its efforts on the results necessary for us to meet DOE's most important needs and expectations. Six Critical Outcomes were established in partnership with DOE. The Laboratory met or exceeded performance expectations in most areas, including these outcomes and the implementation of the Laboratory's Integrated Assessment Program. We believe our overall performance for this evaluation period has been outstanding. A summary of results and key issues is provided below.

1. ENVIRONMENTAL MOLECULAR SCIENCES LABORATORY

Progress towards accomplishing the EMSL critical outcome has met or exceeded overall expectations of performance. Facility construction is slightly behind schedule with no expected impact on overall on-time completion of the EMSL Project. FY96 EMSL Project research and computer equipment cost and schedule performance was very favorable. Several major proposals for new programmatic funding totaling \$6M associated with EM Science Program, the Environmental Technology Partnership Program, and the New Generation Vehicle Program have been awarded to the Laboratory. Good progress has been made in establishing a comprehensive set of performance indicators to track and improve performance of EMSL, the latest in DOE's National Scientific User Facilities. We believe our overall performance rating on this critical outcome is Outstanding.

2. ENVIRONMENTAL MANAGEMENT

The Laboratory made excellent progress toward achieving the Environmental Management Critical Outcome this fiscal year. The Laboratory exceeded expectations in each of the five performance indicators supporting this critical outcome. Fourteen technologies were demonstrated and four were deployed into commercial use. Successes in the leading-edge indicator of entering into formal expressions of interest bode well for future deployments. In addition, the Laboratory continued to receive national recognition for its environmental technologies, as demonstrated by being awarded three R&D 100 Awards and one FLC Award related to environmental applications. Finally, the Laboratory delivered several key products that form the foundation for establishing a scientifically defensible basis for setting remediation priorities at the Hanford site. We believe our overall performance rating on this critical outcome is Outstanding.

3. SCIENTIFIC EXCELLENCE AND PRODUCTIVITY

The Scientific Excellence and Productivity Critical Outcome met or exceeded most FY96 performance expectations. We believe our overall performance rating on this critical outcome is Outstanding. External peer reviews of major programs recognized quality scientific work as well as high relevance to DOE mission needs. Rigorous internal peer reviews of proposals resulted in new programmatic funding commitments totaling \$25M over three years. For the EM Science Program, the Laboratory had the highest success rate in terms of proposals funded and dollar volume among all of the National Laboratories. We believe this is the result of submitting high quality proposals focused on key technology issues.

The Laboratory continues to deliver high value work to customers as evidenced by having five technologies receive R&D 100 Awards. The number of academic collaborations exceeded our highest expectations. This is outstanding especially given reduced budgets in this area.

Other organizations continue to use the Laboratory as a benchmark case for productivity. The average 1830 Contract fully burdened charge-out rate for staff that charge direct continued to decline to \$84.18/hr. In addition, a total of \$20M in overhead savings were captured, surpassing our goal of \$8M. Finally, the Research-to-Support Labor Ratio improved to 1.57:1, falling slightly short of our 1.60:1 goal.

4. ES&H/CONDUCT OF OPERATIONS

The Laboratory made excellent progress toward achieving the results of this critical outcome during FY96. Significant progress was made in establishing the organizational and systems-related infrastructure to support ongoing strong performance. Issues identified at midyear in the Operations Improvement Program (OIP) were successfully addressed and all milestones in the OIP initiative were successfully completed on schedule. Our performance with respect to worker health and safety, environmental protection, and operational work control was very strong and substantiates the Laboratory's commitment to conducting work in a manner that protects the environment, health and safety of staff, and the public. We believe our overall performance rating on this critical outcome is Excellent.

5. LEADERSHIP

The focus of the Leadership Critical Outcome in FY96 was on the short term with the aim of enhancing leadership's performance in achieving business goals and managing staff more effectively. Performance as represented by the performance indicators exceeded some expectations while in one area it fell short. Key to understanding our performance are the results of the FY96 Quality of Work Life (QWL) survey conducted in August which in general, were much more positive than anticipated.

From overall survey results, it appears clear that staff currently express a fair amount of satisfaction with their work, their relationships with coworkers, work autonomy, and support from coworkers for innovation. Staff also are quite positive about their immediate managers. These results suggest that the work itself and immediate management contribute positively towards the staff's overall quality of work life.

Staff expressed more negative opinions about their work environment. Specifically staff expressed perceptions of high work-related stress, considerable insecurity about their jobs and careers, and a lack of commitment both from the Laboratory toward them and from themselves towards the Laboratory. Staff also felt the degree and quality of performance feedback and of support for professional development from management were low. Concerns were also expressed about the Laboratory's alignment toward a successful business future and a lack of understanding of organizational vision and direction.

The Laboratory recognizes there is significant work to accomplish in this area. However, based on the results of the survey, especially in light of the turbulent year the Laboratory has just been through, we believe the Laboratory's performance on this critical outcome has been Excellent when compared to expectations.

6. ECONOMIC DEVELOPMENT

The Laboratory has met or exceeded its Economic Development Critical Outcome goals for FY96. The Laboratory, with specific efforts by the Economic Development Office (EDO), has created 37 new technology-based jobs in the local area in FY96. These jobs cost, on average, less than \$14,000 each to create and represent an increase of more than three and one-half percent in technology-based employment in the Tri-Cities region.

Many of these jobs are the result of the 10 fully operational new technology-based business ventures created by the EDO this year. Of the 15 businesses created during the year, one-third decided, for a variety of reasons ranging from medical imperatives to political campaigning, to slow or postpone continuance of operations in 1996. However, new businesses have been continually added to those launched earlier in the year. The result at year-end, is that we can report 10 viable, new, technology-based businesses that are successfully operating in the Tri-Cities region.

Provision of technical assistance exceeded expectations with a total of 82 firms receiving assistance from the Laboratory's Technical Assistance Program by the end of the fiscal year. Feedback from two key customer sets was obtained: local businesses and local economic development organizations. The local firms, which include 49 from the immediate Tri-Cities area, were surveyed regarding their impressions of the EDO programs and the specific assistance they received. The overall results were even better than those received last year with 93% of all respondents reporting they were satisfied or better with their relationship with the Laboratory and 95% reporting they were satisfied or better with the interaction process of the Technical Assistance Program. An independent assessment completed on the familiarity by local economic development organizations with the Laboratory's EDO reported that these stakeholders perceive the EDO as an organization that has put down roots in the community and ended "lip service" to economic development assistance from the Hanford Site.

We believe our performance rating for this critical outcome is Outstanding.

INTEGRATED ASSESSMENT

We believe that our overall performance rating for the Integrated Assessment Program is Excellent. The Laboratory's approach is comprehensive, fully responsive to DOE's contract reform principles of performance-based management, well integrated with the Laboratory's business planning process, and fully supportive of the needs of the business. The deployment of the Integrated Assessment Program has several strengths, but also some weaknesses. Evidence of senior management involvement is strong within the all six pilot organizations but has not been deployed uniformly throughout all of these organizations. While there are no significant gaps in deployment of the basic requirements, the level of understanding of how to effectively use more contemporary methods of assessment to drive improvement is still immature. There is considerable demonstration of the immediate use of assessment information to correct near-term problems. However, few organizations are demonstrating the use of assessment information in a more cross-cutting, or holistic manner to identify higher level issues associated with the effectiveness of systems. In addition, the lab-level information generated as part of the annual performance evaluation process is still somewhat out of synch with the annual business planning process.

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INTRODUCTION

Our goal for this self-assessment is to provide a critical review of our progress towards accomplishing the Critical Outcomes and to evaluate the quality of the Laboratory's systems used to drive continuous improvement.

This Annual Self-Assessment Report is dramatically different from the report of past years. This year's document is a more focussed, quantitative and objective approach to determining the performance of the Laboratory and is based on the Laboratory's performance toward a set of critical outcomes, objectives and performance indicators that were developed in partnership with our key customers.

To ensure our long-term ability to provide high-value products and services to its DOE customer, the Laboratory evaluated its customer's needs and the current operating environment to develop the six Critical Outcomes. The role of the Laboratory's FY96 Critical Outcomes is to 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 progress toward a specific set of performance indicators. The results of progress toward the critical outcomes are also used to provide DOE-RL with a measurement system by which Laboratory performance can be evaluated.

The Laboratory's FY96 performance evaluation will be determined by a process which is composed of two key elements. The first element, weighted at 75% of the total evaluation, reflects our progress toward accomplishment of the Laboratory's Critical Outcomes.

The second element, weighted at 25% of the total evaluation, reflects the quality of the Laboratory's efforts at continuously improving performance. 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, a more effective self-assessment effort is key to sustaining and improving the overall performance of the Laboratory.

Our progress in implementing the Integrated Assessment Program is only summarized in this report. A detailed description of our approach, deployment of that approach, and use of results to drive improvement is covered in a separate report titled: *Pacific Northwest National Laboratory FY96 Evaluation of the Integrated Assessment Program* (PNNL-11380).

1.0 ENVIRONMENTAL MOLECULAR SCIENCES LABORATORY

The DOE Strategic Plan establishes five primary goals in Science and Technology. These goals include providing science and technology core competencies that enable DOE to achieve its missions, providing new insight into the nature of matter and energy, effectively constructing leading-edge user facilities, adding value to the U.S. economy through application of new technology, and enhancing science education.

Our primary objective in support of DOE's Science and Technology mission is to deliver the Environmental Molecular Sciences Laboratory (EMSL) as a preeminent collaborative research facility. This new facility will be an essential part of the Laboratory's ability to provide the fundamental scientific understanding needed for DOE to successfully achieve its strategic environmental quality and science and technology objectives.

Additionally, EMSL will provide unique resources to the greater scientific community, enhance educational and training initiatives, and facilitate technology development and transfer among federal and state agencies and laboratories, academia, and industry.

For these reasons and in partnership with DOE, the Laboratory has established the following critical outcome, objectives and performance indicators to guide our efforts and monitor progress.

ENVIRONMENTAL MOLECULAR SCIENCES LABORATORY**Summary**

Progress towards accomplishing the EMSL critical outcome has met or exceeded overall expectations of performance. Facility construction is slightly behind schedule with no expected impact to overall on-time completion of the EMSL Project. FY96 EMSL Project research and computer equipment cost and schedule performance was very favorable. Several major proposals for new programmatic funding totaling \$6M associated with the EM Science Program, the Environmental Technology Partnership Program, and the New Generation Vehicle Program have been awarded to the Laboratory. Good progress has been made in establishing a comprehensive set of performance indicators to track and improve performance of EMSL, the latest in DOE's National Scientific User Facilities. We believe our overall performance on this critical outcome is Outstanding.

Objective 1.1: Construct, equip and startup EMSL.**Results**

Activities to construct, equip and startup EMSL continued through FY96 at a very favorable pace demonstrating overall excellent performance on this objective.

Analysis

Cost and Schedule Performance Indices: FY96 Cost Performance Index was 1.03 and Schedule Performance Index was 1.08, both depicting very favorable position, as noted in Figure 1.1. Although there were some equipment delivery delays early in the year, the project was able achieve final delivery and acceptance of equipment ahead of schedule and completion of work at less than budget. We believe our performance was excellent.

Figure 1.1

Change Orders: The four site relocation Change Orders included in the baseline (No's. 10, 12, 37 and 40) were successfully negotiated and settled during the first quarter. We believe this reflects outstanding performance.

Use of Contingency: Facility construction is being accomplished slightly behind schedule with a planned completion date of November 1996, however, no impact on overall Project completion of September, 1997 is expected. Figure 1.2 shows only 5% of contingency funds have been used to date to accommodate construction contract change orders, reflecting excellent performance. Additionally, this is well below the 10-15% level of contingency fund use normally experienced for major construction projects at Hanford.

Figure 1.2

Objective 1.2: Establish impactful programs that fully utilize EMSL.**Results**

Efforts to establish impactful programs and to fully utilize the capabilities of EMSL have been aggressively pursued with very positive results. Twenty-one proposals were funded in FY96 for a total of \$6M in new funding for FY97 demonstrating Outstanding performance on this objective.

Analysis

Progress Against Funding Projections: EMSL made substantial progress in FY1996 in obtaining funding for programs that fall within its mission. Twenty-one proposals were funded in FY96 for a total of \$6M in new funding for FY97. This significantly exceeded the highest expectations of ~\$2M and represents outstanding performance. Of these, one (1) proposal was funded in the OER/OEM Collaboration Program, seven (7) proposals were funded in the EM Science Program, two (2) proposals were funded in the Environmental Technology Partnership Program, and three (3) were funded in the Partnership for a New Generation Vehicle Program. To fully utilize EMSL, the Laboratory is also working to develop relationships with other federal agencies (e.g., NIH, EPA, NSF) as well as industry. The Laboratory is working with the Office of Energy Research to establish clear policies on the use of EMSL by non-DOE programs.

Figure 1.3

User Facility Performance Indicators: As a major DOE "National Scientific User Facility," it is important to establish a comprehensive set of performance indicators to determine whether EMSL is meeting the needs of the external research community. This performance indicator, which in FY1996 focused on the establishment of the appropriate set of performance indicators for EMSL as a NSUF, addresses this issue. A set of indicators has been developed in consultation with the Office of Health and Environmental Research. These Performance Indicators are listed below. The Laboratory's evaluation of our performance in this regard is excellent.

EMSL "National Scientific User Facility" Performance Indicators

- Number of collaborative interactions yearly/Number of permanent professional staff
- Number of Collaborative Projects with Tangible Products Per Year
- Extent of Independent Usage of EMSL User Facilities
- Importance of EMSL's Unique Capabilities (instruments, software, multidisciplinary environment, etc.)
- Availability of Instruments/Facility for Approved Usage
- User Satisfaction

Results of Peer Reviews: Three (3) major peer reviews were held in FY96, all with very positive outcomes. The results of all three support an outstanding performance rating in this area. The first, a review of the EMSL Project, was held on January 23-25, 1996 and involved a twenty (20) person review team with representatives from DOE-HQ, DOE-RL, academia, and other national laboratories. The team reviewed conventional facility construction and equipment acquisitions, project management, cost, schedule and funding; environmental safety and health; and two major research programs (Theory

Modeling and Simulation; Macromolecular Structure and Dynamics). The review team provided numerous favorable comments and no unforeseen shortcomings were identified.

The second peer review was conducted from February 26 to March 1, 1996 and covered research in EMSL sponsored by BES-Chemical Sciences. Program managers from DOE- HQ and reviewers from academia and other national laboratories reviewed our research programs in Chemical Structure and Dynamics and Molecular Theory and Modeling. The peer review was very positive and supportive of on-going research activities.

The third review, also of the EMSL Project, was conducted September 18, 1996. The official report has not yet been received. However, remarks at the close-out session indicated that the Review Team verified that substantial progress had been made and that the project should be completed by August 30, 1997.

Excerpts from peer review reports:

January 23-25, 1996 EMSL Project Review, Summary Report

Conventional Facilities and Management

"Progress on the project has been excellent and facility construction is now 70 percent complete. Awards of the two major computer systems were accomplished significantly under budget, and represent approximately \$1.9M in savings. Facility Construction is slightly behind schedule with the first milestone for early turnover anticipated in May 1996 instead of April 1996. THE LABORATORY'S has made significant progress in the planning for operations activities, and has prepared a comprehensive, integrated operations transition plan."

Theory, Modeling and Simulation

"Scientific work already being performed in Theory, Modeling and Simulation (TM&S) is first rate and the scientific directions have been well chosen. The process for the selection of hardware was good, and the hardware selected was a good value and a good solution for the storage computer system. The EMSL TM&S team is building a first rate parallel system and performing sound software engineering. Although a stronger effort in molecular dynamics is needed. THE LABORATORY'S is addressing this need. Current collaboration efforts in software areas and with experts in macroscopic science and engineering are excellent, although stronger collaborations in statistical simulations and with the Macromolecular Structure and Dynamics Group and the EMSL is recommended."

Macromolecular Structure and Dynamics

"The EMSL Macromolecular Structure and Dynamics (MS&D) team is conducting top quality scientific research and contains a strong core of physical scientists who have solid connections to biological colleagues in other programs and departments at THE LABORATORY'S. However, programmatic research funds may not be sufficient to assure continuity in the high level activities initiated in the MS&D Program as the EMSL begins operation."

February 26-March 1, 1996 BES-Chemical Sciences Peer Review, WH Kirchhoff, Chemical Physics Program Manager,
"The reviews are quite positive and no serious problems have been identified."

September 18-19, 1996 EMSL Project Review, Summary Report

Conventional Facilities

"Significant progress has been made on the project, facility construction is now 94 percent complete. Even with the good progress the Facility Construction completion date has slipped from September 1996 to November 1996. It appears that the new completion date will be easily met and will not impact the overall project schedule for completion. There have been no changes to the project overall technical, cost, and schedule baseline since the January 23-25, 1996 semiannual review."

Transition to Operations

"Both RL and THE LABORATORY'S have made considerable progress in preparing for the start of interim operations along with final operations. The EMSL facility is nearing completion and equipment installation has begun. The Project has a process in place to accept completion of the building and installed equipment. RL has approved this acceptance process and performs checks to ensure that it is being followed."

Objective 1.3: Operate EMSL**Results**

Several activities are underway to transition EMSL into an operational mode. Examples include the preparation of operational standards, preparation for the readiness review, and the identification of key operational staff. FY97 operational funding, however, is not currently approved at a level sufficient to make EMSL research capabilities fully available.

Analysis

Operating Budget: There is only one indicator supporting this objective. It is based on the Laboratory's ability to obtain commitments for the baseline operating budget. A Laboratory Operations Working Group has been established to quantify the FY97 and FY98 EMSL operating budgets based on actual operating expenses and forecasted elements of the EMSL Operating Standard. An FY98 FWP valued at \$30M has been prepared and submitted. The President's budget contains \$5M in EMSL operating funds for FY97 while DOE-HQ is expected to earmark \$8M for FY97 operations. This still falls short of the estimated \$12M needed to make the full research capability of EMSL available to the community in FY97 that could be made available. The ability to establish with DOE-HQ, agreed to operational funding requirements is a concern that continues to receive high priority attention from the Laboratory. The Laboratory is supporting DOE and the supplemental budget process to address this concern.

Another significant concern related to operations which was identified during self-assessment activities is the lack of long term maintenance commitments for lab-level standards development activities. The EMSL operating approach is dependent on the existence of a lab-level set of standards (i.e. a Standards-Based Management System) that can be referenced, or linked to, by EMSL. This issue has been raised to THE LABORATORY'S management for resolution.

Finally, transitioning from EMSL as a project to a fully operational user facility will require full DOE-RL acceptance and support of the "rolling start" concept. Interface with DOE-RL on this item to date has been very good.

EMSL Critical Outcome Performance Rating: The overall performance rating for this critical outcome will be determined by calculating a weighted average for objectives 1.1 and 1.2. Objective 1.3 represents a precondition to achieving an "Outstanding" rating. All calculations are based on the standard 5 point DOE adjectival scale (i.e. Outstanding = 5, Excellent = 4, etc.).

ELEMENT	Results	Evaluation
1. EMSL		
Objective 1.1 Construct, equip and start up EMSL		
1.1.1 CPI and SPI	CPI: 1.03, SPI: 1.08	Excellent
1.1.2 Site Relocation Change Orders Settlement	Completed 1st Qtr FY96	Outstanding
1.1.3 Use of Contingency for Facility Construction	5%	Excellent
Objective 1.2 Establish impactful programs that fully utilize EMSL		
1.2.1 Progress against EMSL funding projections	>\$1.9M	Outstanding
1.2.2 Progress towards establishing baselines for appropriate set of user facility performance indicators	Complete	Excellent
1.2.3 Results of EMSL peer reviews	Complete	Outstanding
Objective 1.3 Operate EMSL		
1.3.1 EMSL Operating budget in DOE baseline	Complete	NA

Determining Overall Performance Rating				
	Weight	Rating (Out, Ex,etc.)	Composite	Score
Objective 1.1	60%	Excellent	4.3	2.6
Objective 1.2	40%	Excellent	4.9	2.0
Objective 1.3	Precondition	Met/ Not-Met	NA	NA
			Total Score	4.6

Total Score	5.0 - 4.5	4.4 - 3.5	3.4 - 2.5	2.4 - 1.5	1.4 - 1.0
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

2.0 ENVIRONMENTAL MANAGEMENT

In support of the DOE's Environmental Quality mission, the Laboratory has a strong leadership role in the reduction of the health and environmental risks associated with both legacy production sites and current operations, and development of environmental technologies.

To fulfill the DOE's strategic intent and to meet the cleanup expectations of the nation's taxpayers, the environmental remediation program will require intense effort over the next few years.

For these reasons and in partnership with DOE, the Laboratory has established the following critical outcome, objectives and performance indicators to guide our efforts and monitor progress.

2.0 ENVIRONMENTAL MANAGEMENT

Summary

The Laboratory made excellent progress toward achieving the Environmental Management Critical Outcome this fiscal year. The Laboratory exceeded expectations in each of the five performance indicators supporting this critical outcome. Fourteen (14) technologies were demonstrated and four (4) were deployed into commercial use, and successes in the leading-edge indicator of entering into formal expressions of interest bode well for future deployments. In addition, the Laboratory continued to receive national recognition for its environmental technologies, as demonstrated by being awarded three R&D 100 Awards and one FLC Award related to environmental applications. Finally, the Laboratory delivered several key products that provide a scientifically defensible basis for setting remediation priorities at the Hanford site. We believe our overall performance rating on this critical outcome is **Outstanding**.

Objective 2.1 Develop high impact technologies that meet user needs

Results

The Laboratory made excellent progress in developing high impact technologies this year, exceeding expectations related to both of the performance indicators supporting this objective. Fourteen technologies were successfully demonstrated, exceeding the FY96 expected level of performance of nine technologies demonstrated, and the Laboratory received three R&D 100 Awards and one FLC Award for technologies with environmentally-related applications, exceeding the FY96 expected level of performance of two awards with environmentally-related applications.

Analysis

Figure 2.1 shows the progress made in successfully demonstrating technologies in FY96. Each demonstration is described in greater detail below. While several of these technologies were funded by, and demonstrated at, non-Hanford sites, they are all relevant to DOE-EM needs. The difficulty in demonstrating technologies at the Hanford site was due, in part, to inconsistent incentives across the various contractors. Efforts to address this concern were undertaken by Laboratory senior management. The selection of Fluor Daniel Northwest (FDNW) as the Project Hanford Management Contractor (PHMC), the incorporation of technology related incentives within their contract, and the subsequent Memorandum of Understanding signed by FDNW and the Laboratory should help resolve this concern. However, the annual funding cycle still causes the majority of our demonstrations to occur late in the year and this continues to create resource management issues and increased stress on staff.

Figure 2.1

Successful Technology Demonstrations

Carbon Dioxide Cleaning was successfully demonstrated to Northwest Fourslide, of Tualatin, Oregon, in November, 1995. Successfully cleaned the client's parts in the Transportable Carbon Dioxide unit and Northwest Fourslide was very pleased with the results.

Arid Engineering System for In-Situ Bioprocessing was successfully demonstrated to Bechtel Hanford Inc. in January, 1996. The activities included initial site characterization and three phases of bioremediation testing. Sufficient data were collected to assess in situ anaerobic bioremediation of carbon tetrachloride relative to baseline technology, demonstrate in situ contaminant destruction while controlling byproduct formation (e.g., chloroform), control the distribution of biomass in the aquifer to maximize the treatment volume while minimizing injection well fouling, and demonstrate an efficient design methodology for in situ bioremediation of chlorinated solvents.

ORNL Confined Sluicing End Effector (CSEE) Prototype was successfully demonstrated to Lockheed Martin Energy Systems in February, 1996. The performance testing indicated that the CSEE prototype has the capability to break up and slurry the sludge wastes on one pass and to remove the slurry during a second pass across the bounding simulated sludge waste. Deployment into the gunite tanks at Oak Ridge is planned for second quarter of FY97.

In-Well Vapor Air Stripping pilot field demonstration to Edwards Air Force Base was successfully completed in March, 1996. The in-well vapor stripping technology was proven to be effective at removing volatile organics from the groundwater. Contamination levels of Trichloroethylene (TCE) in the aquifer at the demonstration site were reduced more than an order of magnitude to below the regulatory limits around the treatment well. The zone of influence is at least 50ft radially from the treatment well. The goal of reducing the TCE concentrations by more than 80% in the downgradient well was exceeded and the ability of the system to obtain the regulatory limits was shown. The Air Force has expressed an interest in continuing the demonstration and expanding the application base-wide.

Pulsair Slurry Mixing was successfully demonstrated to WHC in May, 1996. The Pulsed Air Agitation system provided agitation to tank contents while avoiding the disadvantages of currently employed technologies. The pulsed air testing data gathered at 1/12-scale were used to design a mixer using full-scale-sized plates for the 1/4-scale tank in the 336 Building. The data gathered from the test in the 1/4-scale tank were used to validate the predictions of mixer performance based on an extrapolation of the 1/12-scale data with good results. It is recommended that pulsed air mixing be used as part of the retrieval of solids from tanks V-3 and V-4 at INEL. A deployment concept was generated by the University of Washington, Applied Physics Laboratory, for a pulsed air system in a horizontal tank.

Biosludge Hydrolysis was successfully demonstrated to Tinker Air Force Base in June, 1996. Fourteen bench-scale batch tests and 9 bench-scale continuous tests were conducted. The results showed that acid treatment of the Tinker AFB biosludge resulted in a significant decrease in the amount of biosludge that will require disposal in a landfill. The results were presented to Tinker AFB in July, and, pending approval by Tinker AFB, the design, construction, and start-up of a large-scale system will be initiated.

Instrument Validation was successfully demonstrated to WHC in June, 1996. Nearly 50 experimental conditions were tested as part of a designed experiment to evaluate the instruments and the configuration of an instrument tree which was designed by ICF Kaiser for WHC Project W-211, *Initial Tanks Retrieval System*. The completion of these experiments will allow progress with the construction of the instrument tree because its design has been validated and confidence gained through the demonstration. However, testing also revealed that a new viscometric technique should be chosen to measure slurry viscosity, and quantitative methods for measuring solids concentration and particle size distribution have arisen as future technology development needs.

Base Catalyzed Destruction of PCBs was successfully demonstrated to the Puget Sound Naval Shipyard (PSNS) in July, 1996. A series of 2-L bench scale tests with PCB-containing wastes from PSNS were conducted. Based on the results from the bench-scale testing, a pilot-scale reactor was designed and constructed, and three pilot scale tests were completed with PCB-containing wool felt from PSNS. Analytical results indicated that the PCB concentration was ultimately reduced from more than 70,000 ppm to less than 2 ppm per congener.

Canal Creek, Aberdeen Proving Ground, Aquifer Groundwater Treatability Study was successfully completed for the U.S. Army in August, 1996. Three configurations of innovative groundwater treatment technologies were demonstrated, entailing the treatment of approximately 100,000 gallons over 15 days of operation. Two of the three configurations provided exceptional performance in organic and heavy metal removal, and all three provided adequate data for field performance evaluation. The Army has viewed it favorably and has requested FY97 funds to optimize the system operation. Pending the results of the optimization work, the Army may elect to enlarge the technology system from pilot scale to full-size capability of treating up to 1,000,000 gallons a day.

Microbial Surface Modification of Waste Tire Rubber was successfully demonstrated to Rouse Rubber Inc. (RRI) in September, 1996. The dual bioreactor pilot plant-scale system was operated in a semi-continuous mode for 120 hours, producing 210 pounds of surface treated rubber. Infrared spectroscopy analysis was performed on the surface treated rubber, which showed evidence of partially oxidized sulfur species, the indicator used to characterize the biological degradation of the ground tire rubber. These infrared results confirm that the pilot-scale Rubbercycle bioprocess successfully duplicated results from earlier experiment. Operational data collected during the demonstration run will be used to better define the efficiency and performance of the bioprocess, at a larger scale, and establish more accurate cost-benefit data. The successful operation of the Rubbercycle pilot plant also confirms the feasibility of deploying this technology in an industrial environment. RRI is an enthusiastic partner in the field demonstration planned for FY97.

Settle/Decant in Double Shell Tanks was successfully demonstrated to WHC in September, 1996. Settling tests were performed using the bench-scale settle/decant equipment on actual 241-C-107 sludge for each step of the Enhanced Sludge Washing process. For the proposed pretreatment conditions, gravity settling results were considerably better than the Tank Waste Remediation System (TWRS) baseline. The settling test results were combined with rheological and colloidal work to validate a theoretical settling model, which was used to extrapolate sludge settling to a full-scale system. The model results indicated that sludge compaction to 20 wt% solids in a million-gallon tank requires less than two weeks both for washing and leaching steps for initial sludge concentrations of 5 wt%. This result is improved from the month requirement estimated by TWRS for tank settling.

In Situ Redox Manipulation was successfully demonstrated to Bechtel Hanford Inc., in September, 1996. Twenty-one thousand gallons of buffered sodium dithionite solution were injected into the unconfined aquifer at the Hanford 100-H Area. No significant plugging of the well screen or the formation was detected during any phase of the test. Dithionite was detected in monitoring wells at least 7.5 m (25 ft) from the injection point. Core data show that 60 to 100% of the available reactive iron in the treated aquifer sediments was reduced by the injected dithionite. Eleven months after the injection, groundwater in the injection zone remains anoxic. Hexavalent chromium levels remain below detection limits, and total chromium levels remain in the 1 to 8 ppb range, and continue to decline. In response to a request from Bechtel Hanford Inc., a proposal was developed for the emplacement of a pilot-scale permeable treatment zone using In-Situ Redox Manipulation for the treatment of chromium contaminated groundwater in the 100-D Area. The In Situ Redox Manipulation process has been incorporated into the Ten Year Plan as a treatability study for the Hanford 100-HR-3 Operable Unit.

Supercritical Fluid Parts Cleaning was successfully demonstrated to Pratt & Whitney and NASA in September, 1996. Pratt & Whitney supplied PNNL with several aluminum coupons and a sample of their molydisulfide grease to examine the applicability for using a carbon dioxide based parts cleaning process as a possible substitute to their existing sonified trichloroethylene cleaning process. A test matrix comprised of 80 separate tests was performed with analytically doped coupons which were cleaned at different fluid and system conditions. The matrix also included comparative results with the existing trichloroethylene cleaning procedures. A final cleaning performance test was completed at the "best conditions" using the data results. The results were sent back to the Marshall Space Flight Center for final evaluation. If approved for deployment, a carbon dioxide parts cleaning system will be specified for use at the Pratt & Whitney facility. The data are showing viability for a fairly broad range of cleaning applications.

Laser Ablation/Mass Spectroscopy (LA/MS) demonstration to WHC was completed in September, 1996. The LA/MS instrument system was installed in the 222-S Laboratory Hot Cell facility and was used to obtain initial data on a U-105 tank waste sample. The analytical chemists who reviewed the initial data set were very pleased with the data and saw good correlation between key elemental/isotopic data and a range of waste processing steps which have been used on tank wastes historically. This initial data will be very useful for helping establish rapid tank waste fingerprints.

Awards Related to Environmental Applications: The Laboratory continues to receive national recognition for its environmental technologies. Figure 2.2 shows the number of R&D 100 Awards and FLC Awards received in FY96 for technologies with environmental applications. Each award-winning technology is described in greater detail below. The Laboratory exceeded our expectations of the total number of awards received, even though the opportunity was small given the stiff competition and the diverse set of technology applications (i.e., more than environmental applications are considered in these awards) associated with the awards.

Figure 2.2

Due to reductions in discretionary spending, the total number of R&D 100 Award applications prepared by the Laboratory was reduced by more than 50% when compared to the number of applications submitted over the previous six years.

A more detailed description of the technology and potential applications is provided below.

PNNL FLC Award Winners Related to Environmental Applications

The Laboratory received four FLC Awards for Excellence in Technology Transfer this year. However, only one award was related to environmental applications. John Affinito and team received an *FLC Award for Excellence in Technology Transfer* for PNNL's *Polymer Multi-Layer Technology for Lithium Polymer Batteries*. The Laboratory's technology of producing layered thin film composites enabled the Moltech Corporation to produce high quality, light weight batteries that have high energy-storage and can be recharged for many cycles before they have to be replaced. The improvement to Moltech's batteries will result in increased efficiency in energy utilization, which will result in lower emissions of pollutants that are a byproduct of energy production and utilization.

PNNL R&D 100 Award Winners Related to Environmental Applications

Jeff Surma and team received an *R&D 100 Award* for PNNL's *Catalyzed Electrochemical Oxidation (CEO) Technology*. CEO is a chemical processing system that dissolves, destroys, or decontaminates organic and inorganic materials. It is an effective alternative to incineration for combustible low-level mixed waste forms and streams. CEO was also featured on the cover of the May edition of *R&D Magazine*, with a short article about the technology inside.

John Affinito and team received an *R&D 100 Award* for PNNL's *Liquid Multilayer/Polymer Processes for Vacuum Deposition of Polymer Films*. This technology is described in the FLC Award Winner section on the previous page.

John Downing (former Marine Sciences Laboratory staff member) and a team from Battelle Columbus and Ocean Sciences Company received an *R&D 100 Award* for the *Autonomous Environmental Sentinel*. This multi-sensor probe collects physical and chemical data in aquatic environments. Missile-like and about the size of a baseball bat, the probe is equipped with various sensors and can be deployed from ships, small boats, submersibles, or aircraft.

Objective 2.2: Deploy high impact technologies that meet user needs

Results

The Laboratory made excellent progress in deploying impactful environmental technologies this fiscal year. Performance against two indicators support this conclusion. Nine formal expressions of interest were entered into, exceeding the expected level of performance of two, and four technologies were deployed, also exceeding the expected level of performance of two deployments.

Analysis

A leading-edge, or forecasting indicator, is the number of formal expressions of interest. Formal expressions of interest often lead to the eventual deployment of a technology and the Laboratory monitors these closely. Figure 2.3 shows the number of formal expressions of interest entered into during FY96. Each expression of interest is described in greater detail below. No significant issues were identified in this area.

Figure 2.3

Formal Expressions of Interest Entered Into

Arc Plasma Electroconversion. A License Agreement with Integrated Environmental Technologies was signed in October, 1995, for this solid waste to energy conversion technology. PNNL staff are on Entrepreneurial Leaves of Absence with this startup company, which has a research and development center in the Tri-Cities.

Thermochemical Environmental Energy System (TEES). A License Agreement with local Alligator Corporation, focused on Asian markets, was signed in December, 1995, for this waste-sludge-to-energy conversion technology.

BetaScint In-Field Detection of Strontium Contamination. An exclusive, world-wide license to the patented BetaScint technology was granted to BetaScint, Inc., in January, 1996. This local small business was started by a PNNL employee under the Entrepreneurial Leave of Absence program.

NitRem. Innotek, the Licensee of this ammonium removal and destruction technology for sewer sludge treatment, was awarded a commercial facility design/construction contract with Concurrent Technologies Corporation in February, 1996. A site license for a New York City waste water treatment plant was formalized in June.

Bioremediation Design Tool. Three MOU's have been signed with major remediation companies (OHM Remediation Services, Montgomery Watson, and Parson Engineering Science) for these software tools and methodologies for predicting the performance of in situ bioremediation for chlorinated solvent plumes.

TerraVit. A license agreement with Barnard Environmental, Inc. was signed in March, 1996, for this aluminum and metal plating waste recycling technology. Barnard plans to build a plant in Richland to treat aluminum industry wastes.

Electrical Remediation at Contaminated Environments (ERACE). Negotiations with CIEMAT for a two year option on a license to deploy the ERACE soil remediation technology in Spain were completed during third quarter. CIEMAT is a government funded agency that wishes to identify in-country deployment partners for completing remediation demonstrations and to then market the technology within Spain. The strategic advantage of this agreement is that it provides one entree into the European remediation markets. PNNL staff hope that these demonstrations in Spain will serve to advance and promote our technology so that we can enter other European markets with the U.S. industrial firms with whom we are currently establishing relationships.

Selective Alkane Oxidation (ALKOX). A license agreement with Electrosynthesis Company was signed in May, 1996, for further development of this novel technology for increasing conversion and selectivity of oxidizing methane and other alkanes to useful chemicals.

Aqueous Hydrotreating for Alternative Feedstock Program. A license agreement with International Polyol Company, Inc. was signed in May, 1996. This technology converts products from biomass fermentation into useful chemicals, which is an alternative to conventional hydrocarbon processing of petroleum feedstocks.

Deployed Environmental Technologies: Figure 2.4 shows the number of technologies successfully deployed in commercial practice. Each deployment is described in greater detail below. The Laboratory deployed four environmentally related technologies, thereby exceeding our expected level of performance of two.

The Laboratory believes our strong performance in this area is due to increased focus and investment primarily in the form of key staff that are concentrating on deployment of activities. However, as discussed in the previous objective related to technology demonstrations, the Laboratory continues to work non-technical issues associated with deployment of technologies on the Hanford site.

Actual PNNL Technology Deployments

Geophysical Logging Tools. Geophysical logging represents technology from the oil and gas exploration and production industry which the Laboratory identified and adapted for monitoring and characterization of the Hanford subsurface through a CRADA with the Schlumberger and Halliburton companies. In FY96 Bechtel Hanford Inc. issued a \$200K contract for characterization services in the 100N Area using the logging technique adapted from Schlumberger.

BetaScint In-Field Detection of Strontium Contamination. The BetaScint sensor was deployed at DOE's ITRI facility in Albuquerque, NM, in March, 1996. A series of field measurements were performed to confirm the efficacy of ITRI's strontium remediation efforts at their sewage lagoon site. Deployment of the BetaScint technology at this facility resulted in considerable savings to ITRI and DOE, as the only alternative to this effort would have been costly and time-consuming laboratory analyses of hundreds of soil samples.

Remedial Action Assessment System (RAAS) Software. The copyright for the RAAS software, created to assist the environmental professional in evaluating options for site remediation, was completed in May, 1996. Commercial copies of the software were ready for distribution by the Battelle Press in July, 1996.

Electrical Remediation at Contaminated Environments (ERACE) In Situ Heating. A contract was signed on July 9 with Montgomery Watson for remediation of a contaminated fire training pit at the Niagara Falls Air Force Reserve Station. The contaminated area is approximately 12,000 sq ft, down to a depth of about 8 ft, and the primary contaminant of concern is trichloroethylene. Four arrays were successfully used in August through September to treat the area using the patented 6-phase heating technology. This represents the first time that 6-phase heating has been deployed. A full-scale demonstration of the technology using the same process equipment was performed at the Savannah River site in 1993.

Figure 2.4

Objective 2.3: Provide a scientifically defensible basis for setting remediation priorities

Results

The Laboratory made excellent progress in providing a scientifically defensible basis for setting remediation priorities this fiscal year. Performance against a single indicator supports this conclusion. Four risk management products were delivered, exceeding the expected level of performance of two risk management products delivered.

Analysis

Figure 2.5 shows the number of risk management products delivered that fundamentally impact client's program. Each risk management product is described in greater detail below.

The Laboratory continued to work with key Hanford site stakeholders to improve the understanding of value and acceptance of a fully integrated risk based approach to Hanford site cleanup.

Risk Management Products Delivered

Community Assessment and Prioritization Program (CAPP). CAPP, which was delivered to the Western Area Power Administration in December, 1995, is a user-friendly software package designed to characterize environmental issues, communicate risk information, and assess the adequacy of Western's risk management activities. CAPP has been implemented at Western's headquarters and regional offices.

Development of a Risk-Based Approach to Hanford Site Cleanup. In response to a request from Mr. Thomas Grumbly, Assistant Secretary of Energy for Environmental Management, the Hanford Site contractors, led by PNNL, developed a set of risk-based cleanup strategies that (1) protect the public, workers, and environment from unacceptable risks; (2) are executable technically; and (3) fit within currently expected annual funding profile. This analysis produced a framework and a set of tools that are available for dealing with changes to anticipated funding levels, changes in risk cleanup standards, and Congressional initiatives and inquiries. The study has had a major impact on the development of strategic thinking and plans at Hanford and in the establishment of priorities of effort. It has been distributed and used throughout the Complex, especially by DOE-HQ in its Baseline Environmental Management Report (BEMR) development. The final report was delivered to DOE-RL in December, 1995 [Development of a Risk-Based Approach to Hanford Site Cleanup; PNL-10651].

Privatization Risk Management System. The initial concept to "privatize" the clean-up of Hanford tank wastes met with many detractors, both from within and outside of DOE. The explicit treatment of risk at most of Hanford, prior to the adoption of this system, was basically limited to ES&H. The privatization team expanded the program to include programmatic and technical risks in a common sense approach to identify, assess, and handle these risks in a structured, comprehensive, and systematic manner. The risk based management system developed in the privatization effort focuses management attention on priority items and forms a structured setting for informed management decision making. PNNL delivered the Privatization Risk Management System to DOE in October, 1995, and has refined it throughout the year. This system is considered by DOE-HQ, most recently FM-20, to be the "best in class" and easily the best in the DOE complex. This product clearly resulted in a major shift in the way business was done. The program transitioned from no risk management system to the present program that became the cornerstone of management focus in a "risk based management system".

Development of TWRS Risk/Decision Management Procedures. During FY96, PNNL helped establish risk management and decision management programs within the TWRS Program. Risk management lists were prepared that identified risks and categorized their likelihood and consequences of failure. Critical risk watch lists were reviewed weekly to direct risk mitigation actions. The TWRS risk management program has the potential for serving as a model for the Site Management Board. PNNL also designed and drafted a decision management process that provides a coordinated and systematic mechanism for decision-making within TWRS. The decision management procedure fills a previously unaddressed need to formalize the TWRS decision-making process such that interactions between decision makers and technical analysis staff can proceed in a manner that promotes quality decision-making. Outcomes of TWRS decision making efforts feed directly into the risk management procedures. Taken together, these two procedures invoke a system where impactful decision-based risk management mechanisms are used to plan TWRS program activities. [TWRS Systems Engineering Manual, published May 15, 1996, WHC-IP-1231, Section 6.0, Risk Management, and Section 7.0, Decision Management.]

Figure 2.5

Environmental Management Critical Outcome Performance Rating

The overall performance rating for this outcome will be determined by the rating scale provided below when compared to the sum of the effectiveness scores for the contingency functions.

ELEMENT	Results	Effectiveness Points
2. Environmental Management		
2.1 Develop high impact technologies		
2.1.1 Number of technologies successfully demonstrated	14	100
2.1.2 Number of R&D 100 Awards and FLC Awards related to environmental applications	4	10
2.2 Deploy high impactful technologies		
2.2.1 Number of formal expressions of interest	9	80
2.2.2 Number of technologies successfully deployed in commercial practice	4	90
2.3 Provide a defensible basis for setting priorities		
2.3.1 Number of risk management products delivered that fundamentally impact client's program	4	25
Total Effectiveness Points		305

Total Score	305 - 180	179 - 55	54 - (55)	(56) - (150)	(151) - (245)
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

3.0 SCIENTIFIC EXCELLENCE & PRODUCTIVITY

The Laboratory's goal is to bring new scientific knowledge to bear on DOE's environmental, energy, and national security missions.

In addition, DOE continues to emphasize efforts needed to provide a technically trained work force for the nation in the future. The Laboratory will continue its contributions to systemic reform of scientific and mathematics education.

Finally, the Task Force on Alternative Futures for the Department of Energy, led by Robert Galvin, recommended sweeping changes in governance and management practice. Other initiatives commissioned by the Department have made it clear that cost pressures will increase over the near term.

For these reasons and in partnership with DOE, the Laboratory has established the following critical outcome, objectives and performance indicators to guide our efforts and monitor progress.

3.0 Scientific Excellence and Productivity

Summary

The Scientific Excellence and Productivity Critical Outcome met or exceeded most FY96 performance expectations. We believe our overall performance rating on this critical outcome is **Outstanding**. External peer reviews of major programs recognized quality scientific work as well as high relevance to DOE mission needs. Rigorous internal peer reviews of proposals resulted in new programmatic funding commitments totaling \$25M over three years. For the EM Science Program, the Laboratory had the highest success rate in terms of proposals funded and dollar volume among all of the National Laboratories. We believe this is the result of submitting high quality proposals focused on key technology issues. Academic collaborations and interactions between the Laboratory and schools, colleges and universities continued to increase and exceeded our expectations, especially given overall reduced levels of funding in this area.

The Laboratory continues to deliver high value work to customers as evidenced by having five technologies receive R&D 100 Awards. The number of academic collaborations exceeded our highest expectations. This is outstanding especially given reduced budgets in this area.

Other organizations continue to use the Laboratory as a benchmark case for productivity. The average 1830 fully burdened charge-out rate for staff that charge direct continued to decline to \$84.18/hr. In addition, a total of \$20M in overhead savings were captured, surpassing our goal of \$8M. Finally, the Research-to-Support Labor Ratio improved to 1.57:1, falling slightly short of our 1.60:1 goal.

Objective 3.1 - Scientific work will have an impact on DOE missions needs.

Results

The Laboratory believes the results of peer reviews, both in terms of direct feedback from external reviewers and funding decisions made as a result of peer reviews, recognize the *outstanding* quality of our science and relevance to DOE mission needs. In addition, the importance of peer review in validating and improving the quality and relevance of the research at the Laboratory was significantly increased this year as evidenced by:

- (1) an increase in the number of peer reviews of our major programs and actions taken in several areas as a result of the peer reviews,
- (2) the use of extensive internal and external peer reviews to improve the quality of our major proposal submissions (EMSP, ETP, PNGV) which was instrumental in our high success rate, and
- (3) the development of a plan for implementation beginning in FY97 of a comprehensive, integrated peer review system.

Analysis

External Peer Reviews of Major Programs: The following research programs were reviewed by external peer review panels in FY-1997.

Chemical Physics
Free Radical Chemistry of Coal
Tank Focus Area Research Projects
Efficient Separation Program
EMSL

Office of Basic Energy Sciences (OBES), Division of Chemical Sciences
Office of Basic Energy Sciences (OBES), Division of Chemical Sciences
Office of Environmental Management, Tank Focus Area
Office of Environmental Management, EM-50 Division
Office of Health & Environmental Research, Environmental Sciences Div.

Medical Products
Materials SciencesPacific Northwest National Laboratory, Energy Division
Office of Basic Energy Sciences (OBES), Division of Material Sciences

In general, the peer reviews recognized the high scientific quality, productivity and mission relevance of the research programs at the Laboratory. Appendix A provides a summary report for each of the program reviews with the exception of the EMSL peer reviews (the EMSL project was reviewed twice this year and these reviews are summarized under the EMSL critical outcome). Each summary report presents a brief review highlighting strong and weak parts of the program and actions undertaken to improve the quality, productivity and relevance of our research.

Perhaps the best testimony to the quality and mission relevance of our research programs comes from our Office of Basic Energy Sciences (OBES) programs supported by the Materials Sciences and Chemical Sciences divisions. The OBES programs in this Laboratory did not receive any budget cuts in FY97 despite OBES receiving a 4% programmatic budget reduction in FY97 compared to FY96 which has forced them to greatly reduce or eliminate research programs at several laboratories.

Peer Review of New Proposal Submission

The Laboratory was extremely successful in obtaining programmatic funding from several new DOE initiatives during FY96. Three year funding commitments totaling over \$25M dollars were received from the Environmental Technology Partnership (ETP), Vehicles of the Future and the Environmental Management Science Program (EMSP) initiatives. Prior to proposal submission to DOE-HQ for their peer review of scientific quality and mission relevance, the Laboratory conducted extensive internal peer reviews to ensure that all proposals had both high scientific quality and the research was targeting key technology problems. For example, Laboratory staff developed over 150 proposal ideas for the EMSP initiative from which 21 full proposals were submitted. The Laboratory believes that the rigorous, internal peer review of the EMSP proposal submissions was a key factor in gaining funding for 10 out of 21 submissions. This was the highest success rate in terms of proposals funded and dollar volume (>\$15M over three years) among all of the National Labs.

Another example of the use of external peer review results involved a proposal to the Wolf-Broido initiative. The proposal, initially unsuccessful, was modified based on peer review comments and resubmitted and eventually funded.

In addition to three major DOE initiatives, the Laboratory received funding commitments in FY96 for two new proposals from the Contaminant Plume Containment and Remediation Focus Area (OEM), two new proposals from the Atmospheric Radiation Measurement Program (OER), one proposal from the ER/EM environmental initiative (OER-Wolf-Broido initiative), and a major new health effects research program in the area of Nucleotide Excision Repair was approved for funding following an extensive peer review by Office of Health and Environmental Research (OER). Again, rigorous internal peer review was a factor in improving the quality of these successful proposals.

Integrated Peer Review System

In FY-96, the Laboratory committed to the implementation of an integrated, comprehensive peer review program for the laboratory. This peer review plan was the product of internal workshops and has been reviewed and approved by management, representatives of DOE-RL and the Laboratory Advisory Committee. The key elements of the plan are the formation of a Laboratory Review Committee (LRC) composed of the Chairs of the Division Review Committee (DRC) for each research Division and the establishment of a more formal system of internal peer review of all products (publications, proposals, reports) from the Laboratory. Formal implementation will begin in FY97.

Objective 3.2 - Deliver high value work to customers including excellence science program, high benefit technology, and the transfer of technology.

Results

Several performance indicators reveal that the Laboratory continues to provide high value work to customers. The receipt of five (5) R&D 100 Awards and the number of academic collaborations exceeded our highest expectations. Customer feedback was not comprehensively collected, but for those projects surveyed in the last quarter of the year, results generally indicate the work being done is valued and performed according to expectations. Academic collaborations and interactions between the Laboratory and schools, colleges and universities continued to increase and exceeded our expectations, especially given overall reduced levels of funding in this area.

Analysis

Number of R&D 100 Awards: The Laboratory received five awards exceeding expectations with respect to this performance indicator. In March 1996, the Laboratory submitted nine nominations for R&D 100 Awards. The Laboratory was notified on June 25, that it had won four awards. However, the Laboratory's name was inadvertently left off a submission, a joint entry with Battelle Columbus and Ocean Sensors. *R&D Magazine* corrected their records, but not in time to catch the September issue of the magazine announcing the winners. Figure 3.1 shows a downward trend in the number of submissions due primarily to the cost of preparation.

R&D 100 Awards

SPIRE® (Spatial Paradigm for Information Retrieval and Exploration) Software
PSQ - Plasma Source Mass Spectrometer
Liquid Multilayer/Polymer Processes for Vacuum Deposition of Polymer Films
CEO - Catalyzed Electrochemical Oxidation
Autonomous Environmental Sentinel (AES)

Figure 3.1

In April, as an element of our self-assessment, Intellectual Property Management Office (IPMO) conducted a debriefing meeting with the writers and Communication Program Managers to discuss lessons learned and improve our internal processes. As a result, the Laboratory championed two retirees as R&D 100 judges this year. Their participation will provide a better understanding of what the judges find important and necessary.

Customer Feedback from Key Customers & Critical Projects: During July and August 1996, product line managers obtained customer feedback information from a set of customers. Based on analysis of the customer feedback information, the data indicates that for the set of projects where feedback was obtained, the Laboratory is performing project work that has medium-to-high strategic value, and performing the work in a manner rated medium-to-high by the customers.

The customer feedback survey was structured along the lines of value assessment activity conducted as part of the Achieving the Competitive Edge (ACE) initiative. Two dimensions were involved: 1) strategic value of the work to the customer, and 2) project performance. Questions on the survey were answered according to a low-medium-high scale.

The data collected using the customer feedback process in the last quarter of the year is not of sufficient reliability to be used to draw any conclusions about the Laboratory's overall portfolio of projects. By design, the focus of the data collection was intended to be the feedback provided by key customers on critical projects, i.e. those most important to the Laboratory, and not a statistically based sample of all projects so that conclusions could be drawn about the Laboratory. Even so, some key projects and customers were not sampled or did not provide feedback. Various factors contributed to this such as year-end workload, internal issues concerning the approach, and customers that were unwilling to respond. However, implementation of this indicator provided valuable insights and lessons learned for improvement. In addition, numerous written comments to open-ended questions were also received and this information has been passed on to the appropriate Product Line Manager for their use. An independent assessment of the customer feedback process has already provided a set of recommendations for consideration in FY97.

As originally proposed the survey was designed around a 5 point scale. A threshold value of 3.0 (on the 5 point scale) was the basis for establishing performance expectations. However, the line organizations responsible for implementing the survey requested that a low-medium-high rating scale be used instead. As a result, a threshold value of 2.5 (i.e., low=1, medium=2, high=3) was used to evaluate the responses. It should be noted that comparisons between a 5 point scale and a 3 point scale are not reliable.

Information was obtained from 77 projects addressing 15 of the 25 product lines. These 15 product lines represent about 50% of the research business volume. Figure 3.2 summarizes the feedback received. Because of the problems noted above, it is impossible to make comparisons to the value assessment data collected during ACE. It is clear that additional work is needed before this indicator can be reliably used.

Figure 3.2

Number of Academic Collaborations: Although the formal performance indicators is based solely on collaborations, Figure 3.3 shows the final number of collaborations and interactions. The final number of collaborations (724) is 134% of the maximum expected level (550) for FY96. Results have been outstanding in this area, especially given the reduced levels of funding. The Laboratory believes the increased level of collaboration is partially attributable to the emphasis placed on this by the EM Science Program, as well as funds received at mid-year from DOE Headquarters for pre-college student and teacher programs. In addition, more research programs shared the cost of sponsoring students, this may be due in part, to a resistance to hiring full-time staff in these uncertain times.

Figure 3.3

Number of Publications in Peer Reviewed Journals: The focus of this indicator for FY96 was to establish a baseline and cost-effective method for capturing the data. A database search for the time period October 1, 1995 through September 30, 1996 yielded 491 publications by Pacific Northwest National Laboratory staff in peer reviewed journals. This number is higher than expected, in light of the baseline data of nearly 400 publications in CY94, and given the turmoil in the Laboratory during FY95 and early FY96 due to staff reductions. In addition, there is some variation in the journal titles the Laboratory has published in most frequently. A table of comparison for the journal titles is provided below.

Over 10,000 journals were searched in SciSearch, MEDLINE, INSPEC, Ei COMPENDEX, BIOSIS, CA (Chemical Abstracts) and EMBASE using the STN online system, looking for Pacific Northwest Laboratory and derivatives. The results were limited to articles only and the final results were manually scanned to remove inappropriate citations. Social SciSearch was also searched through the DIALOG online system to locate unique citations. In this search, a total of 619 items were found. Three (3) were by other parts of Battelle, 8 were duplicates, 28 were not in the target time frame, 81 were articles in book series or books, and 8 were publications that were not peer reviewed, for a final count of 491 valid papers.

Comparison between CY94 and FY96, Top 21 Journals Published

Journal Titles with highest number of Pacific Northwest National Laboratory authors	Number CY94	9/30/95-9/30/96
Journal of Chemical Physics	24	24
Journal of Physical Chemistry	11	19
Journal of the American Chemical Society	4	16
Applied Occupational and Environmental Hygiene	0	13
Surface Science	4	12
Radiation Research	5	11
Journal of Nuclear Materials	37	10

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Nuclear Instruments & Methods in Physics Research	3	9
Analytical Chemistry	3	9
Radiation Protection Dosimetry	6	8
Water Resources Research	5	7
Rapid Communications in Mass Spectrometry	1	7
J. Radioanal. Nucl. Chem.	2	7
Environmental Science & Technology	6	6
Chemical Physics Letters	5	6
Health Physics	4	6
Physical Review Letters	0	6
Bioelectromagnetics	3	5
Journal of Mass Spectrometry	0	5
Journal of Toxicology and Environmental Health	0	5
Journal of Vacuum Science & Technology	2	5

A number of factors have influenced the results of this year's database searches. These factors and others will have to be addressed in order to assure the reliability of the data, especially when setting performance expectations for future years.

Objective 3.3: Operate in cost-effective manner as demonstrated by strong project execution, low overhead costs, while maintaining a high quality of work life.

Results

The Laboratory exceeded expectations with respect to cost-effectiveness and was acknowledged by the Department as a benchmark case for addressing costs. Fully burdened chargeout rates declined from FY95 to an average of \$84.18/hr for staff that charge direct, overhead savings of \$20M were captured, and the research-to-support labor cost ratio increased to 1.57:1, falling just short of our internal stretch target of 1.6:1. In addition, results from a Quality of Work Life survey were pleasantly surprising in many dimensions although the need for continued attention to several areas, including providing performance feedback to staff, enhancing job security, and reducing work-related stress, was also indicated.

Five performance indicators support the evaluation of progress towards this objective. Three performance indicators support our cost-effectiveness evaluation. The two remaining performance indicators supporting project execution and quality of work life are under development and efforts this year are focused on implementing the indicator and establishing baseline information.

Average Fully Burdened Charge-out Rate: Average fully burdened charge-out rate per hour for staff that charge direct is a key indicator of cost-effectiveness for our customers. In essence, it is the cost customers pay for our technical staff to work on their problems. Figure 3.4 shows the improvement in charge-out rate over the past few years. The laboratory met its goal of an ~\$84 charge-out rate. Given the significant reduction in business volume (~\$50M) and direct charging FTE's (224 FTE's from FY95), this represents a major accomplishment and required reducing overhead cost by ~\$20M.

Figure 3.4

Although not a performance indicator agreed to in the contract, the following table shows a decreasing trend in total overhead per project FTE.

Constant FY96\$	FY94	FY95	FY96	FY94-96 Change
Total Overhead	\$224,420K	\$201,428K	\$165,438K	-26.3%
Project FTE	\$2,043K	\$1,953K	\$1,729K	15.4%
Overhead/FTE	\$110K	\$103K	\$96K	-12.8%

Table 3.1

Research to Support Labor Cost Ratio: Another key indicator at the Laboratory level, and for our customers, is the Research/Support labor cost ratio. This indicator provides some insights into how effectively the Laboratory is being managed, i.e. the degree to which our overhead costs are driven by support labor costs. Our FY96 performance was 1.57:1, a significant improvement over the 1.41:1 in FY95. However, this improvement fell short of our desired ratio of 1.60:1 and was a direct result of attrition in research FTE's outpacing hiring.

Level of Overhead Savings: The level of overhead savings far exceeded expectations. The FY96 savings were \$20M versus a desired savings of \$8M. Concurrently, a loss of recovery resulting from a decline in direct charging FTE's required drastic overhead cost reductions to prevent an increase in overhead rates. Although the Laboratory was successful in reducing costs and not raising overhead rates, some cost reductions may not be sustainable.

Discipline in Project Execution: The objective for this performance indicator in FY96 was to establish a Laboratory-wide baseline on how well projects achieved their budget and schedule commitments. In order to ensure that a reasonable baseline was established, 29 projects were selected from across the Laboratory to participate in the analysis. These projects represented:

- four research divisions,
- a range of project sizes from small research projects to elements of large complex multi-function projects, and
- a variety of customers, including DOE-RL, DOE-HQ, WHC, and internally funded projects.

Each project provided baseline scope, milestone, and budget information that had been agreed to with their respective customers. A database was developed and maintained specifically for this purpose. Actual and forecast project performance information was collected monthly relative to the total fiscal year budget and schedule milestones.

Budget Analysis: Twenty-one of the 29 projects (or 72%) were completed (or are forecasted to be completed) within their respective baseline budget. Of the eight projects that overran their respective FY96 budgets:

- Four projects (14%) finished within 3% of the baseline budget.
- Four projects (14%) finished over 3% of the baseline budget.
- One of the overrun projects was actually a subset of a larger PNNL managed program. The program underran its' FY96 authorized budget.
- One project currently has a change request pending due to a significant scope increase.

Schedule Analysis: Sixty-two of the 95 milestones (or 65%) were completed on or ahead of their respective schedule baselines. Of the 33 milestones completed (or forecasted to be completed) behind schedule, only six (6%) actually impacted the final completion date of their respective projects and only two of these six had schedule slippages greater than 1 month. Final performance to the baseline milestones follows:

- 14 milestones (15%) were completed ahead of schedule
- 48 milestones (50%) were completed on schedule
- 15 milestones (16%) were less than 1 month behind schedule.
- 6 milestones (6%) were between 1 and 2 months behind schedule.
- 2 milestones (2%) were between 2 and 3 months behind schedule.
- 10 milestones (11%) were more than 3 months behind schedule.

It is important to note that many of the milestones included in this analysis were internal project milestones that were neither on a project's critical path nor formally agreed to with the client. Thus, the change control process was not always practiced as rigorously on these internal milestones as it was on key client milestones. There were also cases where the Laboratory and the client did not have a defined change control process. In these situations (and for the purpose of this study), the internal milestone was not changed and an unfavorable variance was recorded. Examples of these situations are provided below:

Cultural Resources Project (No. 11930) - Milestone "Survey and Update Inventory Information for the 100 Area Islands" was late by 62 days due to high runoff of the Columbia River during this past spring. Because this milestone did not impact the project's critical path and was not a key client milestone, a change request was not processed.

Waste Tank Flammable Gas (No. 25127) - A contributing factor to Milestone "Issue FY95 Actual Waste Gas Generation Report" being late was due to late delivery to PNNL of client-furnished samples. A change request was submitted and subsequently denied by the client.

Ten milestones (30% of the late milestones) were contained in two international projects: **Ukraine Dry Cask Spent Fuel Storage System (No. 22415A)** and **Smolensk RBMK Fire Safety Upgrades (No. 22415B)**. The actual work is being performed by offsite fixed-price subcontractors. Because of technical issues associated with the work scope, schedule slippages occurred. The issues causing the delays have been identified and are being managed by the assigned PNNL project management team.

Although the results of this analysis were not outstanding, the primary purpose of this performance indicator was to establish a cost and schedule performance baseline for the Laboratory to measure future improvement against. This objective has been achieved. In a majority of those cases where unfavorable

cost or schedule variances occurred, actions were taken to minimize their impact to overall project performance. The analysis also provided additional insight into the importance of effective communication with the client regarding scope, schedule, budget, and change management.

Quality of Work Life: A Quality of Work Life (QWL) survey was developed and sent to all 3549 PNNL staff in August, 1996, as a means of assessing and monitoring staff perceptions of their work and their work environment. In addition, the survey was designed to support several performance indicators included in the Leadership Critical Outcome, such as satisfaction of Technical Group Managers (TGMs) with the support they received from their managers and satisfaction of women and minorities in succession plans with support for their career development. The survey represented a revised and updated version of the earlier Quality of Work Environment (QWE) survey, administered in August 1995 as part of the Achieving the Competitive Edge (ACE) initiative.

The QWL survey differed from the QWE survey in several ways. The QWL survey:

- Contained fewer items (70 versus 82)
- Was sent to all PNNL staff, rather than a random sample of 50%
- Eliminated some QWE composites, such as Benefits, Work Area, and Work Schedule which showed very positive results, but little variation among staff members
- Added several composites, including composites soliciting feedback on the performance of the Laboratory Director and the Associate Laboratory Directors/Directors
- Revised and improved some items, based on statistical item analyses of the QWE results
- Asked for additional demographic information, with the goal of providing feedback of survey results to all levels of staff

The rating scale was the same for both surveys, i.e. a seven-point Likert scale ranging from "strongly agree" to "strongly disagree".

Of the 3549 surveys which were mailed, a total of 2140 (or 60.3%) were returned and usable. The return rate varied by organizations, ranging from a high of 84.6% to values in the low 40% range for other groups. The 60.3% return rate was quite consistent with the 63% return rate obtained for the ACE QWE survey and is a relatively high value for a mailed survey.

Results for the Laboratory as a whole on the composites are provided in Figure 3.5. Note that a higher composite mean indicates more positive perceptions, while lower values indicate more negative perceptions.

Figure 3.5

Unfortunately, there are no hard and fast rules for labeling composites as being good/bad or positive/negative based on the mean value (unless they are extreme).

The following "rules of thumb", based on extensive survey experience using 7-point rating scales, are offered.

- Differences can be considered important if they exceed 0.5 Likert units.
- Mean composite values above 6.0 reflect very positive perceptions.
- Mean values from 5.0-6.0 reflect positive perceptions.
- Mean values from 4.0-4.5 may reflect considerable ambivalence or could represent the ratings of a number of dissatisfied individuals.
- Mean composite values of less than 4.0 indicate fairly negative perceptions.

As can be seen, means for four of the composites exceeded 5.0, suggesting that staff were, overall, quite satisfied with these aspects of the quality of their work life. These were Relationships with Coworkers (mean= 5.42), Job Satisfaction (mean= 5.26), Support for Innovation (mean= 5.21), and Autonomy (mean= 5.58). Composite means for My Immediate Manager (mean= 4.96) and Valued as an Individual (mean= 4.87) were also relatively positive. At the other extreme, low composite means were found for ALDs/Directors (mean= 4.03), Performance Feedback from Management (mean= 3.99), Job Security (mean = 3.99), and Job-related Stress (mean= 3.94). Ratings for the Laboratory Director (mean= 4.34), Commitment (mean= 4.25), and Strategic Alignment (mean= 4.27) were also low. Standard deviations for each composite ranged from 1.15 to 1.71. A detailed analysis of the survey results has been completed and will be made available to staff and management.

Overall, the 1996 QWL survey has been valuable in identifying aspects of the work environment that were going well for PNNL members as well as identifying problems and issues. While not all results were positive, the results could have been worse, given the turbulent environment and events of the past year. The Laboratory is undoubtedly fortunate as an organization that staff have shown so much resilience in "hanging in there" and continuing to produce quality work in spite of the negative perceptions of the work environment. A number of actions have already been initiated by management to improve the quality of working life and additional actions, motivated by the survey results, are being planned to address issues raised by the survey.

Scientific Excellence and Productivity Critical Outcome Performance Rating

The overall performance rating for this outcome will be determined by the following rating scale when compared to the sum of the effectiveness scores from the contingency functions.

ELEMENT	Raw Score	Effectiveness Score
3. Scientific Excellence and Productivity		
3.1 Scientific work will have an impact		
3.1.1 Results of Peer Reviews	Outstanding	100
3.2 Deliver high-value work to customers		
3.2.1a Customer feedback: Strategic Value	66.2%	25
3.2.1b Customer Feedback: Performance	85.1%	55
3.2.2 Number of R&D 100 Awards (3 yr Ave.)	FY96 = 5 (3.3 Ave)	20
3.2.3 Number of academic collaboration	724	20
3.2.4 Publications in peer reviewed journals	Completed (491)	5
3.3 Operate in cost-effective manner		
3.3.1 Level of discipline in project execution	Completed	25
3.3.2 Average fully burdened charge-out rate for staff that charge direct	\$84.18	40
3.3.3 Level of overhead savings	\$20M	15
3.3.4 Research to Labor Support Ratio	1.57:1	15
3.3.5 Quality of Work Life Composite	Completed	5
Total Effectiveness Score		325

Total Score	395 - 281	280 - 101	100 - (169)	(170) - (359)	(360) - (470)
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

4.0 ES&H/CONDUCT OF OPERATIONS

The Department's Strategic Plan communicates a strong and unambiguous commitment to operations to ensure the health and safety of our work force and the public and with respect for the environment. Although our environment, safety and health statistics are good as compared to industry, we recognize our operating practices may not yet conform to the standard of excellence expected by DOE.

For these reasons and in partnership with DOE, the Laboratory has established the following critical outcome, objectives and performance indicators to guide our efforts and monitor progress.

ES&H/CONDUCT OF OPERATIONS**Summary**

The Laboratory made excellent progress toward achieving the results of this Critical Outcome during FY96. Significant progress was made in establishing the organizational and systems-related infrastructure to support ongoing strong performance. Issues identified at midyear in the Operations Improvement Program (OIP) were successfully addressed and all milestones in the OIP initiative were successfully completed on schedule. Our performance with respect to worker health and safety, environmental protection, and operational work control was very strong and substantiates the Laboratory's commitment to conducting work in a manner that protects the environment, health and safety of staff, and the public. We believe our overall performance rating on this critical outcome is **Excellent**.

Objective 4.1: Establish the organizational/systems-related infrastructure for ES&H and Conduct of Operations.**Results**

Significant progress was made in establishing the organizational and systems-related infrastructure to support ongoing strong ES&H and Conduct of Operations performance. Constraining issues identified at midyear related to two projects within the OIP, the development of Facility Use Agreements and the Standards Based Management System, were successfully addressed and all milestones in the OIP initiative were successfully completed on schedule. Customer surveys focused on ES&H and operational issues of both internal and external customers were completed at midyear and year-end. The surveys validated improvements and provided valuable information regarding areas in need of increased or continuing attention. Overall performance on this objective is considered excellent.

Three performance indicators support this objective: Performance Against OIP Master Schedule; Results of External Customer Feedback; and Results of Internal Customer Feedback. These are discussed below.

Analysis

The primary driver behind the softening of progress at midyear was the number of competing activities in the system. The combined impacts of reorganizing, downsizing budgets, reestablishing markets to position the organization for future growth, significant audits during the second quarter, the DOE EH-3 interactions on a Price Anderson Amendments Act Potential Notice of Violation, and new initiatives such as implementation of the customer service business model temporarily focused attention and resources away from progress on some of the essential elements of this objective.

During the last half of the fiscal year, significant emphasis was placed on achieving OIP milestones. All milestones have been met, resulting in a performance rating of excellent. Figure 4.1 summarizes the overall OIP milestones, schedule and associated performance expectations.

Figure 4.1

Significant Milestones Accomplished

The Radiological Control Initiative milestone to issue all Radiological Control Manual implementing procedures was completed on March 31, 1996, three months ahead of schedule.

All 66 Facility Use Agreements, including those for the three Category 2 nuclear facilities, have been completed.

The Standards Based Management System has been implemented and 36 Laboratory Wide Procedures have been developed. This list includes the 30 procedures needed by EMSL prior to the start-up of operations and additional procedures related to the Laboratory's Integrated Assessment Program. With the exception of three Lab-level manuals (PNL-MA-05 – Nuclear Material Control & Accountability, PNL-MA-40 – Security, and PNL-MA-45 – Unclassified Computer Security Manual) that have not been placed online due to security considerations, all Lab-level manuals are now electronically available to staff.

Implementation of the Integrated Assessment Program including establishing the Independent Oversight function, development of Lab-level procedures and guidance, and evaluation criteria.

The Training and Qualification OIP milestones were completed on schedule. The Training and Qualification Department was implemented by October 1, 1995. The Training and Qualification Manual, PNL-MA-4, was developed and available to staff May 1, 1996. The Training and Qualification Management System Description was completed in August.

Results of External and Internal Customer Feedback

Based on the FY96 completion of two comprehensive internal and external surveys, both conducted by the BMI Corporate Vice President for ES&H and other BMI staff, and one action plan, the performance rating for each of these two indicators is determined to be excellent.

The first feedback survey of internal and external customers was performed March 18-22, 1996, and the final report was issued on April 8, 1996. This comprehensive survey established a baseline of customer opinions and perspectives about the status and performance associated with the various initiatives within the OIP. The results of the survey indicated that:

"Roles, responsibilities, accountabilities, and authorities (RRAAs) have been established for OIP initiative development, implementation, and verification. OIP alignment with the Lab's Quality Rule Implementation Plan has been established in an integrated milestone schedule. Several OIP initiatives are proceeding well, under good leadership. However, the initial momentum for some of the OIP initiatives seems to have slowed. In particular, resources are not being applied to the standards-based management system (SBMS) initiative to ensure success. The other OIP initiatives depend on SBMS results to be effective. Also, customer expectations for milestone deliverables appear to exceed the level of commitment for achievement."

The resulting action plan was to focus renewed attention on meeting the FY96 commitments on the SBMS and the Facility Use Agreements. The action plan proved effective because, as identified above, all of the FY96 OIP milestones were met.

The second feedback survey of internal and external customers was performed during August 26-30, 1996, to assist in improving ES&H performance, and to evaluate program effectiveness. The focus of the assessment was on internal and external customer opinions and perspectives about the status of initiatives related to the ES&H program, and to validate customer satisfaction with ES&H performance. The assessment report, dated September 17, 1996, indicated the following:

"Roles, responsibilities, accountabilities, and authorities (RRAAs) have been established for ES&H initiative development, implementation, and verification. Management system alignment with the Lab's Quality Rule Implementation Plan has been established in an integrated milestone schedule. During this assessment, several ES&H initiatives were observed to be well underway, and progressing on schedule. The momentum for the leadership initiative has slowed, being paced to follow the development of management system standards. Development of the Integrated Assessment Program (IAP) seems to be well received by RL managers. Some RL customer communication expectations are not being met, due in part to RL managers being unavailable to Battelle (attributed somewhat to transitioning the Hanford Integrating Contractor into their role)."

The second survey, although decidedly more positive than the first, identified issues requiring attention. These issues are being addressed.

Objective 4.2: Achieve operational excellence in worker safety and health, environmental protection, and operational work control.

Results

Performance with respect to worker health and safety, environmental protection, and operational work control was excellent and substantiates the Laboratory's commitment to conducting work in a manner that protects the environment, the health and safety of staff, and the public. Progress toward accomplishing this objective is determined by analyzing the combined results (or composites) of 21 performance indicators grouped into three topical areas: worker safety and health (which achieved an overall excellent rating);

environmental protection (achieved an outstanding rating); and operational work control (also achieved an outstanding rating). These three areas are analyzed and discussed in more detail below.

Worker Health and Safety Composite Analysis

The worker health and safety composite is divided into two areas of focus, Safety & Health and Radiological Control (see below). Overall, expectations for performance were met. However, this is due primarily to strong performance in Radiological Control that offsets weaker performance in Safety and Health.

Safety and Health: The composite performance with respect to this area is addressed by three indicators as follows:

Lost Workday Case Incidence Rate: Performance in this area is outstanding. The FY96 incidence rate of 1.0 is the best performance for the Laboratory in the past ten years in this area and is 40% below the average for all DOE R&D laboratories. We believe this performance demonstrates that the Laboratory's approach to worker safety and health through field-deployed professionals is helping to eliminate the more severe accidents by providing direct technical assistance to line managers.

Occupational Safety & Health Cost Index: Even though the Cost Index value of 9.96 only rated a good, it should be noted that the PNNL historical Cost Index has been in the range of 20. Thus, this performance is a major improvement over the past several years. Experience this year indicates that closer attention needs to be paid to case management. An initiative in FY97 is focused on this area to help staff return to work more quickly and safely following lost workday accidents and injuries. In general, our assessment of this particular measure is that it is not an effective indicator of performance because it may be inappropriately influenced by a single trivial event (e.g., a minor job modification that does not materially affect the scope of the worker's assignment), which can cause a significant swing in the measure. For these and other reasons, the Laboratory will propose to discontinue the use of this measure as a performance indicator in 1997.

Motor Vehicle Loss Rate: This indicator presents the property value lost for reportable motor vehicle accidents (government vehicles only) in dollars per 1000 miles driven. A December 31, 1995 truck/steam pipe accident incurring approximately \$28K in property damage caused the Laboratory to far exceed the maximum loss expected, and resulted in an unsatisfactory rating on this indicator. In retrospect, it appears that recording motor vehicle losses on an annual basis, when the number of miles driven annually is low (as is the case here), is too volatile to be an effective performance indicator for any given year.

Radiological Control

Performance indicators in this area for FY96 support an excellent rating. Several self-assessments confirmed the strength of key aspects of the program. These key strengths include the technical qualifications of staff and the radiological engineering program. However, the fact that several other self-assessments clearly identified the need for continued improvement, especially with respect to management oversight of radiological work activities, leads us to rate our overall FY96 performance in Radiological Control as good.

Seven indicators support the radiological control composite.

Collective Dose: The Laboratory achieved significant reductions in collective dose during FY96. The Laboratory total collective dose estimate for FY96 was 73.901 REM. We are currently

projecting a year-end total dose of 60.308 REM (actual year-end doses will not be available until late October). The majority of the reductions were achieved through process improvements and decontamination efforts at the 324 Building. The reductions resulted in an excellent rating for this indicator.

Unplanned Exposures: Two unplanned exposures resulting in doses greater than the administrative control levels, resulted in an unsatisfactory rating for this indicator. Both of these unplanned exposures were related to off-normal occurrences and corrective actions have been developed and implemented. The events were attributed to startup issues with respect to implementing our enhanced radiological control program. Additional controls are now in place.

Reportable Skin and Personal Clothing Contaminations: The Laboratory experienced 10 skin and personal clothing contaminations in FY96. This represents a reduction of 50% compared to FY95, and continues a long-term downward trend in the number of personnel contamination events. This represents outstanding performance.

Confirmed Reportable Unplanned Depositions: There were no reportable confirmed unplanned depositions in Laboratory facilities in FY96. This indicator reflects outstanding performance in the area of contamination control and confirmed unplanned depositions prevention at the Laboratory.

Airborne Events Outside Airborne Radioactivity Areas: There were no confirmed mission-related airborne radioactive material concentrations greater than 10% of a Derived Air Concentration (DAC) in an accessible area not controlled and posted as an Airborne Radioactivity Area at Laboratory facilities in FY96. The resulting rating is outstanding.

Reduction in Contamination Areas: The Laboratory achieved outstanding reductions in the size of areas posted for the control of contamination. Most of the 9,499 square feet of reduction was due to the reposting of the Shielded Materials Facility (SMF) gallery in the 324 Building.

Loss of Control of Radioactive Material (non-legacy): The Laboratory experienced two events during the last quarter that involved loss of control of sealed radioactive sources. This represents unsatisfactory performance in this area. In one event, a liquid scintillation counter with an internal check source was inadvertently released for public sale through WHC. In the other event, an instrument with an internal check source was not listed in the sealed source inventory. Corrective actions to prevent a recurrence have been implemented.

Several self-assessments were conducted this fiscal year. Two key learnings were that technical qualifications of staff were found to be equal to or better than other DOE Multi-program Laboratories and that a number of areas for improvement in radiological control-related business processes are possible from the customers' perspective.

Summary of the Radiological Control Related Assessments

Two internal audits (respiratory protection and nuclear accident dosimetry) were completed in FY96. Two significant findings were identified in the area of nuclear accident dosimetry. One of these was reported under DOE Order 232.1-1 as an Off-Normal Occurrence (RL-PNNL-PNNLNUCL-1996-0041). This condition involved failure to require Personnel Nuclear Accident Dosimeters (PNADs) in locations where an installed nuclear criticality detection system is required.

On August 5, 1996, PNNL self-reported a potential violation of 10 CFR 835 through DOE's Non-Compliance Tracking System (NTS). In this event, Radiological Control Technicians and Radiological Workers failed to comply with selected

Radiological Control Implementing Procedures and/or Radiological Work Permits. This represented multiple control failures within the boundaries of a single occurrence, as described in DOE Handbook, HDBK-1089-95, CH. 3, Sec. A (2). There were no indications of an adverse impact on environment, safety and health. The NTS tracking number is NTS-RL-PNNLNUCL-1996-0001.

An unscheduled independent assessment by staff from BMI Corporate was performed in September in response to NTS-RL-PNNLNUCL-1996-0001. This assessment determined that overall performance on radiological control is marginal, and that additional management oversight of radiological work is needed.

An unscheduled external assessment of the radiological engineering function was completed in July. The assessment team consisted of JE Martin, Ph.D, CHP, and TA Peterson, PE. The assessment was generally positive, although the team expressed a concern about the long-term viability of the radiological engineering team after transfer of the 324 and 327 Buildings and associated radiological engineering staff to the PHMC.

During the first half of the fiscal year, the high number of external assessments impacted the effectiveness of the radiological control self-assessment program. The Radiological Control Program received more than 13 formal surveillances and assessments by DOE during the first half of the fiscal year. These included programmatic assessments by the DNFSB, EH-22, RL (LMD and OTR), as well as facility-specific assessments by RL (LMD and ESH).

Environmental Protection Composite Analysis

Five performance indicators support the Environmental Protection composite. At the end of FY96, the rating for the overall composite was Outstanding. The individual indicators that make up this composite are discussed below:

Legacy Waste: In 1995 the Laboratory compiled a list (known as the "Silver List") of 31 legacy/orphan wastes (wastes with lost institutional history, ownership, funding, or for which a pathway to compliant management had not been identified) and regulatory noncompliances and voluntarily disclosed this information to the State of Washington Department of Ecology. The Laboratory and DOE determined that 25 issues on the list could be resolved in FY96. Despite a severe shortage of resources, staff were able to resolve 24 of the "Silver List" issues by the end of FY96, resulting in an outstanding rating for this indicator (see Figure 4.2).

Figure 4.2

Pollution Prevention/Waste Minimization: In FY96, the Laboratory achieved a 57% reduction in low level waste, a 10% reduction in mixed low level waste, a 58% reduction in hazardous waste, and a 10% increase in white paper recycling (relative to the 1994 baseline and indexed to business volume). The target for a 5% reduction of TRU waste was not met (TRU waste generation increased 67%). These reductions combined to produce an excellent rating for this indicator. Data was corrected as much as possible to remove double-counting and non-routine wastes. Note: The October 1995 data for paper recycling was not available, but a conservative estimate (based on average recycling rates in the previous and subsequent six months) was assumed.

Percent of Projects Reviewed for NOC Requirements: All 101 modification permits were reviewed for Notice of Construction (NOC) requirements under the air compliance regulations. Training was provided to staff reviewing Prep & Risk Forms to ensure they were evaluating proposed projects for NOC requirements. The rating for this indicator is outstanding.

Compliance with 331 NPDES Discharge Limitations: There were no exceedances of the NPDES discharge permit parameters for the 331 Building outfall, thus achieving a rating of good, the highest rating available for this indicator.

Certain Off-Normal Events Involving Spills: This indicator tracked the number of ORPS reportable releases of hazardous substances, regulated pollutants, and oils. There were no reportable occurrences in FY96, compared to two in FY95. This performance resulted in an outstanding rating on this indicator.

Operational Work Control Composite Analysis

Progress in this area exceeded expectations. Six performance indicators comprise the operational work control composite and as a result of developing these specific indicators, significant organizational learning occurred and continues. Staff and management have a better understanding of operational needs and are working toward better utilization of resources.

Work Requests: The current average age of Work Requests is 42 days. This is much better than the historical average of 60 days, but there is still room for improvement. Monthly averages for August and September were much higher than other months. This is attributed to effects of long term jobs, movement of bargaining unit staff to implement the transfer of the 324 and 327 Buildings, delay of exhaust system work due to a protracted evaluation initiated from an employee concern, shift of emphasis to program work, and preparation for start up of EMSL. These activities either shifted the workforce to long duration jobs or assigned them to work which was not related to completion of work requests (particularly small lower priority tasks which normally have quick turnaround).

Engineered Expense Work: The cumulative year-to-date age of Engineered Expense Work is 229 days. When compared to the historical average of 300 days, this continues to be highly favorable. While this age is positive, it should be noted that it is based on a small number of tasks (34) and as such does not provide significant overall performance measurement. Consequently, this indicator will be deleted in FY97 and other indicators related to life cycle asset management will be included.

Work Request Backlog: The year-end Work Request Backlog rate is 53% and, when compared to the historical average of 60%, continues to reflect positive performance. This, like the Work Request indicator, was affected by several year-end perturbations (see Work Request above).

Overtime Work Ratio: The year-end Overtime Work Ratio is 6.3% compared to a historical average of 8%. Although there were monthly variations, the year to date average was consistently near 6% demonstrating consistent overall positive performance.

Planned Multiple-Use Outages: Fully 34% of the planned facility outages for the year have been scheduled to allow for the execution of multiple tasks. This is significantly better than the target of 23% to achieve outstanding performance. Under current operational modes, outage management attention does produce minimal occupant impact and has an additional benefit of increasing effectiveness of work planning and control.

Preventive Maintenance (PM) Work: This indicator tracks the percent of preventive maintenance costs to total maintenance costs. Efforts of the PM Committee to adjust PM documentation to match facility missions and needs provided outstanding results as indicated by the year-end PM ratio of approximately 12.7%. This performance has been institutionalized within the PM program as evidenced by the consistent level of performance throughout the year. Therefore, this measure will not be carried into FY97.

Indicator: Preventive Maintenance (PM) Work			Target
Indicator Description	Percent of preventive maintenance costs to total maintenance costs	Indicator Data	12.7%
Indicator Data	Percent of preventive maintenance costs to total maintenance costs	Indicator Data	12.7%
Indicator Data	Percent of preventive maintenance costs to total maintenance costs	Indicator Data	12.7%
Indicator Data	Percent of preventive maintenance costs to total maintenance costs	Indicator Data	12.7%
Indicator Data	Percent of preventive maintenance costs to total maintenance costs	Indicator Data	12.7%
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Indicator Data	Percent of preventive maintenance costs to total maintenance costs	Indicator Data	12.7%
Indicator Data	Percent of preventive maintenance costs to total maintenance costs	Indicator Data	12.7%
Indicator Data	Percent of preventive maintenance costs to total maintenance costs	Indicator Data	12.7%

Indicator	Target	Actual	Variance	Comments
Indicator 1	100%	100%	0%	Excellent
Indicator 2	100%	100%	0%	Excellent
Indicator 3	100%	100%	0%	Excellent
Indicator 4	100%	100%	0%	Excellent
Indicator 5	100%	100%	0%	Excellent
Indicator 6	100%	100%	0%	Excellent
Indicator 7	100%	100%	0%	Excellent
Indicator 8	100%	100%	0%	Excellent
Indicator 9	100%	100%	0%	Excellent
Indicator 10	100%	100%	0%	Excellent

ES&H/ConOps Critical Outcome Performance Rating

The overall performance rating for this critical outcome will be determined by calculating a weighted average for objectives 1.1 and 1.2. All calculations are based on the standard 5 point DOE adjectiveal scale (i.e. outstanding = 5, excellent = 4, etc.).

ELEMENT	Results	Rating	Effectiveness Score
4. ES&H/ConOps			
4.1 Establish the organizational/systems related infrastructure for ES&H			
4.1.1 Performance against OIP master schedule	Completed on Time	Excellent	4.0
4.1.2 Results of external customer feedback survey	Complete	Excellent	4.0
4.1.3 Results of internal customer feedback survey	Complete	Excellent	4.0
Overall Objective 4.1 Rating:			Excellent
4.2 Achieve operational excellence in worker safety and health, environment protection and operational work control			
4.2.1 Worker health and safety composite (40%)		Excellent*	1.6 Pts
4.2.2 Environmental protection composite (30%)		Outstanding*	1.5 Pts
4.2.3 Operational work control composite (30%)		Outstanding*	1.5 Pts
Total Score			4.6 Pts

* Note: See supporting data on following pages.

Determining Overall Performance Rating				
	Weight	Rating (Out, Ex, etc.)	Value (5, 4, etc.)	Effectiveness Score
Objective 4.1	50%	Excellent	4	2.0
Objective 4.2	50%	Excellent	4.6	2.3
			Total Score	4.3

Total Score	5.0 - 4.5	4.4 - 3.5	3.4 - 2.5	2.4 - 1.5	1.4 - 1.0
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

Worker Health & Safety SubIndicators	Results	Effectiveness Score
4.2.1 Worker Health & Safety Composite		
Collective Dose	60.308 REM	40
Unplanned Exposures Above Administrative Control Limits	2	-65
Skin and Personal Clothing Contaminations	10	35
New Confirmed Unplanned Internal Depositions	0	80
Airborne Events in Accessible Locations Not Controlled and Posted as Airborne Activity Areas	0	40
Net Change in Areas Posted and Controlled as Contaminations Areas, High Contaminations Areas and Airborne Radioactivity Areas	9499 Sq Ft.	65
Uncontrolled Release of Radioactive Materials	0	40
Occupational Safety & Health Cost Index	9.96	5
Lost Workday Case Incident Rate	1.0	70
Motor Vehicle Accident Loss Rate	\$28K	-50
Total Composite Points		260

Total Score	640 - 480	479 - 160	159 - -149	-150 - -450	<-451
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

ELEMENT	Results	Effectiveness Score
4.2.2 Environmental Protection Composite		
Legacy Waste	24 Solved of 25	70
Pollution Prevention/Waste Minimization	4 of 5 Targets Met	80
Permit/Criteria Exceedences: Air	100% Reviewed	80
Permit/Criteria Exceedences: Water	0 Discharges	0
Permit/Criteria Exceedences: Spills	0 Occurrences	65
Total Composite Points		295

Total Score	390 - 292	291 - 98	97 - 105	-106 - -315	<-316
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

ELEMENT	Results	Effectiveness Score
4.2.3 Operational Work Control Composite		
Work Requests	42 Days	100
Engineered Expense Work	229 Days	90
Work Request Backlog	53%	25
Overtime Work Ratio	6.3%	50
Planned Multiple-Use Outages	34%	50
Preventive Maintenance Work	12.7%	40
Total Composite Points		355

Total Score	410 - 308	307 - 103	102 - -95	-96 - -284	<-285
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

5.0 LEADERSHIP CRITICAL OUTCOME

The Department of Energy's Strategic Plan establishes four primary critical success factors. Two of these critical success factors are Communication and Trust, and Human Resources. We recognize that the heart of the Laboratory is made up, not of facilities and equipment, but of our research and support staff. Managing the Laboratory in the complex world of today requires effective and involved leaders. The recognition that effective leadership is critical to our success, both at the personal level and at the institutional level, is especially important in light of the programmatic and staff reductions the Laboratory experienced in 1995.

For these reasons and in partnership with DOE, the Laboratory established the following critical outcome, objectives, and performance indicators to guide our efforts and monitor our progress.

LEADERSHIP**Summary**

The focus of the Leadership Critical Outcome in FY96 was on the short term with the aim of enhancing leadership's performance in achieving business goals and managing staff more effectively. Performance as represented by the performance indicators exceeded some expectations while in one area it fell short. Key to understanding our performance are the results of the FY96 Quality of Work Life (QWL) survey conducted in August which in general, were much more positive than anticipated.

From overall survey results, it appears clear that staff currently express a fair amount of satisfaction with their work, their relationships with coworkers, work autonomy, and support from coworkers for innovation. Staff also are quite positive about their immediate managers. These results suggest that the work itself and immediate management contribute positively towards the staff's overall quality of work life.

Staff expressed more negative opinions about their work environment. Specifically staff expressed perceptions of high work-related stress, considerable insecurity about their jobs and careers, and a lack of commitment both from the Laboratory toward them and from themselves towards the Laboratory. Staff also felt the degree and quality of performance feedback and of support for professional development from management were low. Concerns were also expressed about the Laboratory's alignment toward a successful business future and a lack of understanding of organizational vision and direction.

The Laboratory recognizes there is significant work to accomplish in this area. However, based on the results of the survey, especially in light of the turbulent year the Laboratory has just been through, we believe the Laboratory's performance on this critical outcome has been Excellent when compared to expectations.

Objective 5.1 The Laboratory's leaders/managers lead people effectively and are achieving their business goals in a quality manner

Results

The FY96 QWL survey revealed a number of interesting results in the area of leadership. The Technical Group Managers (TGMs) were more satisfied with the support they are receiving than expected and the staff in general were more positive than expected with respect to the movement toward a results-oriented culture. Specific results supporting the FY96 performance indicators reveal:

- 86% of Technical Group manager's rated their satisfaction with their preparation and support of their management as 4 or greater (on a 7 point scale), (maximum anticipated was 85%).
- 71% of women and persons of color expressed positive perceptions regarding their development plans (expected level was 75%).
- 66% of PNNL staff expressed positive perceptions about the movement of the Laboratory toward a results-oriented leadership culture (maximum anticipated was 65%).

The FY96 Quality of Work Life Survey also sends a clear message however, that leadership can be improved in the areas of providing performance feedback, creating development plans for staff and management, and making certain that staff are intimately familiar with the mission of the Laboratory and that their work is properly aligned and supports the mission.

Analysis**Technical Group Manager satisfaction support of their management**

The Quality of Work Environment (ACE) survey composite titled "My Manager" was used to establish a baseline for FY96. Level 3 managers in line organizations were selected as the appropriate subgroup for analysis.

This performance indicator for FY96 is based on the percentage of staff with an average composite rating of 4.0 or greater on the seven point Likert scale. The FY96 QWL survey used a composite (i.e. collection of questions related to this specific category) titled, "My Immediate Manager."

Figure 5.1 shows the relevant results from the survey conducted in August. The survey determined that 86.4% of the TGMs responding rated their support from management at 4.0 or higher. This exceeded the maximum expected value of 85%.

Figure 5.1

Percent of women and people of color in succession plans expressing positive perceptions of development plans

A FY96 baseline for this indicator was not established from historical data. However, a management decision was made to establish the following standards for percentages of women and people of color expected to rate developmental plans at 4.0 or greater on a seven point Likert scale on the QWL survey: maximum = 85%, neutral = 75%, and minimum = 65%.

Going into the year, succession plans were not in place in the Laboratory. It was agreed that a supplemental survey would be conducted, focusing on women and people of color who were recognized as "high potentials." The supplemental survey was composed of questions from the QWL survey.

As Figure 5.2 shows, 70.97% of the respondents to the supplemental survey rated their satisfaction at 4.0 or greater, approximately 6% above minimum. This result appears consistent with informal feedback provided by staff where there are concerns about first line supervisory training and the lack of resources available to support professional and career development.

Figure 5.2

Staff perception of movement of PNNL toward a results-oriented leadership culture

The Organizational Effectiveness survey (conducted during ACE) composite titled "Organization Direction" was used to establish the baseline for FY96. This performance indicator is based on the percentage of staff who rated this composite at 4.0 or greater and was measured using the QWL survey composite (again, a series of related questions) titled "Strategic Alignment."

As shown in Figure 5.3, 64.5% of the respondents rated this overall composite 4.0 or higher, thus exceeding our maximum expected level of performance by approximately 4%. This seems to indicate that efforts this past year to develop, communicate and track progress against the Laboratory's "agenda" (i.e. set of strategic objectives, critical outcomes, performance indicators, etc.) is having desired results. Quarterly staff meetings held by the Laboratory Director with all managers, Division/Directorate efforts to communicate within their own organizations, and the attention to tracking results stemming from the Laboratory's Integrated Assessment Program are all possible contributors.

Figure 5.3

Percent of Technical Group Manager positions for which performance standards and expectations are defined and documented

The percentage of standards and expectations to be developed was established by management decision (i.e. no reliable historical data was available). The levels of performance that were agreed to for the purposes of this performance evaluation were: maximum = 90%, neutral = 70%, and minimum = 50%.

Roles, responsibilities, accountabilities and authorities for Technical Group Managers were defined as a part of the Laboratory Business Model. This model was first articulated in December, 1995 and efforts to better define and communicate the model and associated responsibilities have been ongoing since then. Divisions adapted these general roles, responsibilities, accountabilities, and authorities to meet division specific requirements. Standards and expectations are further defined in the individual staff member's Staff Development Report (SDR). Although some progress has been made, substantial work remains with respect to adequately communicating TGM standards and expectations, and implementing them across the Laboratory. The Laboratory assumes a neutral level of performance in this area, i.e. some progress is evident but not substantial.

Percent of performance indicators developed for the two new leadership objectives

The intent on this performance indicator was to track progress on the development of additional indicators that were desired in order to support the remaining objectives under this critical outcome (i.e., they would become effective in FY97).

Leadership

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Of the two objectives that were originally proposed, a performance indicator supporting one of them will be captured in FY97 as part of the Scientific Excellence Critical Outcome (i.e., recognition by the scientific community). The other objective, under this Critical Outcome dealing with influence on the national science and technology agenda will not be incorporated as part of the FY97 critical outcomes.

The measurement for the FY96 indicator was established as a "yes" or "no" and therefore did not have a performance range established as do many of the other performance indicators. The Laboratory believes the intent of developing new indicators for FY97 was accomplished, but that no points should be awarded.

Item	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
1.1	100%	100%	100%	100%	100%
1.2	100%	100%	100%	100%	100%
1.3	100%	100%	100%	100%	100%
1.4	100%	100%	100%	100%	100%
1.5	100%	100%	100%	100%	100%
1.6	100%	100%	100%	100%	100%
1.7	100%	100%	100%	100%	100%
1.8	100%	100%	100%	100%	100%
1.9	100%	100%	100%	100%	100%
1.10	100%	100%	100%	100%	100%
1.11	100%	100%	100%	100%	100%
1.12	100%	100%	100%	100%	100%
1.13	100%	100%	100%	100%	100%
1.14	100%	100%	100%	100%	100%
1.15	100%	100%	100%	100%	100%
1.16	100%	100%	100%	100%	100%
1.17	100%	100%	100%	100%	100%
1.18	100%	100%	100%	100%	100%
1.19	100%	100%	100%	100%	100%
1.20	100%	100%	100%	100%	100%
1.21	100%	100%	100%	100%	100%
1.22	100%	100%	100%	100%	100%
1.23	100%	100%	100%	100%	100%
1.24	100%	100%	100%	100%	100%
1.25	100%	100%	100%	100%	100%
1.26	100%	100%	100%	100%	100%
1.27	100%	100%	100%	100%	100%
1.28	100%	100%	100%	100%	100%
1.29	100%	100%	100%	100%	100%
1.30	100%	100%	100%	100%	100%
1.31	100%	100%	100%	100%	100%
1.32	100%	100%	100%	100%	100%
1.33	100%	100%	100%	100%	100%
1.34	100%	100%	100%	100%	100%
1.35	100%	100%	100%	100%	100%
1.36	100%	100%	100%	100%	100%
1.37	100%	100%	100%	100%	100%
1.38	100%	100%	100%	100%	100%
1.39	100%	100%	100%	100%	100%
1.40	100%	100%	100%	100%	100%
1.41	100%	100%	100%	100%	100%
1.42	100%	100%	100%	100%	100%
1.43	100%	100%	100%	100%	100%
1.44	100%	100%	100%	100%	100%
1.45	100%	100%	100%	100%	100%
1.46	100%	100%	100%	100%	100%
1.47	100%	100%	100%	100%	100%
1.48	100%	100%	100%	100%	100%
1.49	100%	100%	100%	100%	100%
1.50	100%	100%	100%	100%	100%
1.51	100%	100%	100%	100%	100%
1.52	100%	100%	100%	100%	100%
1.53	100%	100%	100%	100%	100%
1.54	100%	100%	100%	100%	100%
1.55	100%	100%	100%	100%	100%
1.56	100%	100%	100%	100%	100%
1.57	100%	100%	100%	100%	100%
1.58	100%	100%	100%	100%	100%
1.59	100%	100%	100%	100%	100%
1.60	100%	100%	100%	100%	100%
1.61	100%	100%	100%	100%	100%
1.62	100%	100%	100%	100%	100%
1.63	100%	100%	100%	100%	100%
1.64	100%	100%	100%	100%	100%
1.65	100%	100%	100%	100%	100%
1.66	100%	100%	100%	100%	100%
1.67	100%	100%	100%	100%	100%
1.68	100%	100%	100%	100%	100%
1.69	100%	100%	100%	100%	100%
1.70	100%	100%	100%	100%	100%
1.71	100%	100%	100%	100%	100%
1.72	100%	100%	100%	100%	100%
1.73	100%	100%	100%	100%	100%
1.74	100%	100%	100%	100%	100%
1.75	100%	100%	100%	100%	100%
1.76	100%	100%	100%	100%	100%
1.77	100%	100%	100%	100%	100%
1.78	100%	100%	100%	100%	100%
1.79	100%	100%	100%	100%	100%
1.80	100%	100%	100%	100%	100%
1.81	100%	100%	100%	100%	100%
1.82	100%	100%	100%	100%	100%
1.83	100%	100%	100%	100%	100%
1.84	100%	100%	100%	100%	100%
1.85	100%	100%	100%	100%	100%
1.86	100%	100%	100%	100%	100%
1.87	100%	100%	100%	100%	100%
1.88	100%	100%	100%	100%	100%
1.89	100%	100%	100%	100%	100%
1.90	100%	100%	100%	100%	100%
1.91	100%	100%	100%	100%	100%
1.92	100%	100%	100%	100%	100%
1.93	100%	100%	100%	100%	100%
1.94	100%	100%	100%	100%	100%
1.95	100%	100%	100%	100%	100%
1.96	100%	100%	100%	100%	100%
1.97	100%	100%	100%	100%	100%
1.98	100%	100%	100%	100%	100%
1.99	100%	100%	100%	100%	100%
2.00	100%	100%	100%	100%	100%

Leadership Critical Outcome Performance Rating

The overall performance rating for this outcome will be determined by the following rating scale when compared to the sum of the effectiveness scores for the contingency functions.

ELEMENT	Results	Effectiveness Score
5. Leadership		
5.1 PNL's Leaders/Managers lead people		
5.1.1 PI: Technical Group Manager satisfaction with their preparation and the support of their management	86.4%	90
5.1.2 PI: Percent of women and people of color in succession plans expressing positive perceptions of developmental plans	71%	-35
5.1.3 PI: Staff perception of movement of PNL towards a results-oriented leadership	64.54	100
5.1.4 PI: Percent of Technical Group Manager positions for which performance standards and expectations are defined and documented	70%	0
5.1.5 PI: Percentage of performance indicators for the two new Leadership Objectives (See Note 1)	1 Complete 1 Not Complete	0
5.2 Leadership shapes the national science and technology		
5.2.1 Progress towards development of performance indicators	NA	NA
5.3 The Laboratory is recognized nationally for significant contributions to science and technology		
5.3.1 Progress towards development of performance indicators and Critical Outcome Performance Rating	NA	NA
Total Effectiveness Score		155

Total Score	340 - 201	200 - 61	60 - (79)	(80) - (219)	<(219)
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

Note 1: This indicator was based on development of FY97 Indicators for Objectives 5.2 and 5.3, above. Indicators for Objective 5.3 have been developed and included in the FY97 Scientific Excellence Critical Outcome. Indicator(s) for Objective 5.2 have not been addressed in the FY97 Critical Outcomes. For this reason, we do not feel it prudent to either claim all the points for Indicator 5.1.5, nor do we believe PNNL should be penalized all the points and we have opted to select "0" points for this indicator.

6.0 ECONOMIC DEVELOPMENT OFFICE

As a derivative of the Department of Energy's core missions, the DOE Strategic Plan establishes goals to help industry make the transition to pollution prevention and waste minimization. In addition, the DOE 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.

For these reasons, and in partnership with the DOE, the Laboratory has established the following critical outcome, objectives and performance indicators to guide our efforts and monitor progress.

Summary

The Laboratory has met or exceeded its Economic Development Critical Outcome goals for FY96. The Laboratory, with specific efforts by the Economic Development Office (EDO), has created 37 new technology-based jobs in the local area in FY96. These jobs cost, on average, less than \$14,000 each to create and represent an increase of more than three and one-half percent in technology-based employment in the Tri-Cities region.

Many of these jobs are the result of the 10 fully operational new technology-based business ventures created by the EDO this year. Of the 15 businesses created during the year, one-third decided, for a variety of reasons ranging from medical imperatives to political campaigning, to slow or postpone continuance of operations in 1996. However, new businesses have been continually added to those launched earlier in the year. The result at year-end, is that we can report 10 viable, new, technology-based businesses that are successfully operating in the Tri-Cities region. These new businesses, as intended, are strategically aligned with the principle economic clusters identified as critical to the future growth and diversity of the Tri-Cities; they include four new businesses operating in the environmental services sector, three in the health/medical products sector, two in the agri-business sector and one in the energy sector.

Results in the provision of technical assistance also exceeded expectations with a total of 82 firms receiving assistance from the Laboratory's Technical Assistance Program by the end of the fiscal year. These firms, which include 49 from the immediate Tri-Cities area, were surveyed regarding their impressions of the program and the specific assistance they received. The overall results were even better than those received last year with 93% of all respondents reporting they were satisfied or better with their relationship with the Laboratory and 95% reporting they were satisfied or better with the interaction process of the Technical Assistance Program.

As documented in ethnographic surveys of the Tri-Cities' principle economic development entities and authorities, improvements were also made by the EDO in levels of awareness of, and participation in, its programs and activities over the course of this fiscal year. An initial survey of EDO's stakeholders, the 26 agencies and entities of the economic development community, was conducted early in the year. The results indicated that while the EDO was well-regarded by its seven primary stakeholders, there were several entities who had limited or no knowledge of its programs or accomplishments. Efforts were made to improve stakeholders awareness of the EDO. In August/September a followup survey was conducted to assess the EDO's performance as measured by the perceptions of this stakeholder group. The results reveal that levels of awareness among the 26 stakeholder organizations have risen dramatically. The author of the assessment, a WSU-TC graduate student, reports that the economic development stakeholders in the Tri-Cities perceive EDO as an organization that has put down roots in the community and ended "lip service" to economic development assistance from the Hanford Site.

We believe our performance rating on this critical outcome is Outstanding.

Objectives: Create technology based business growth in the Tri-Cities through entrepreneurial spin-offs, partnerships, asset conversions and assist companies in generating new sales

Impact of Assistance on Local Employment**Results**

The Laboratory was credited with creating 37 new technology-based jobs in its first full year of operation. The jobs were a result of the new ventures the EDO helped to establish and the technical assistance it provided to new and existing technology-based firms. The number of jobs created is well beyond levels

typically associated with traditional first-year economic development efforts. Consistent with expectations, these firms receiving technical assistance in 1996 are projecting much greater job creation in the future, thus positively impacting the employment base of the Tri-Cities' economic region. With the creation of 37 new technology-based jobs, employment in the technology-based firms of the Tri-Cities region expanded by 3.5%.

Analysis

Using data provided by the Tri-City Commercialization Partnership (TCCP), TRIDEC, and supplemented by the Washington Manufacturer's Register, we identified a total of 66 small, technology-based businesses doing business in the Tri-Cities and surrounding area in 1995. These firms met the criteria of relying for their viability on the use or development of new and innovative technology in the manufacture, sale or application of their products or services. The firms on this list were reviewed with respect to this criteria by representatives of the Port of Benton and WSU-Tri-Cities. The results are summarized below.

These firms were estimated to have total employment of 1,030 people in 1995 and now form the baseline against which the Laboratory will assess the Economic Development Office's (EDO) impact on the local economy. While this suggests an average of 15 employees per firm, the fact is that most firms employ between 2 and 5 people as revealed in the following table:

Baseline Number of Employees	Number of firms	1996 PNNL Technology Based New Ventures
0 - 2	4	0
2 - 5	20	9
5 - 10	13	1
10 - 25	8	0
25 - 50	5	0
50 - 100	2	0
100 - 250	2	0
N/A	12 *	0

*The data available from published sources failed to provide employment rates for 12 of the 66 small, technology-based firms. The missing data were provided by calls to the firms in question or by statistical interpolation relating size of sales or other available and highly correlated information to employment.

Return on Investment (ROI) is the ratio of the number of new technology-based jobs attributable to the efforts of the Economic Development Office divided by the total amount of direct programmatic funds expended on the creation of those jobs. In this case, the denominator is made up of the following elements:

ER Technical Assistance (DOE-HQ)	\$104,000
EM Technical Assistance (DOE-RL)	117,200
EntLOA Assistance (DOE-RL)	157,800
EM Partnerships (DOE-RL)	<u>135,350</u>
TOTAL	\$514,350

The result is that each job created in 1996 by the Economic Development Office cost just under \$14,000.

Number of New Businesses Started in the Area**Results**

We have created or helped form 15 new businesses in the Tri-Cities area during FY96. As expected, however, not all of them developed at the same rate and, for various reasons ranging from medical imperatives to political campaigning, five have not evolved as planned. Therefore, only those businesses that are reported as fully operational by fiscal year end are listed in our year-end business statistics.

Analysis

The "*" companies in the following listing are being tracked for the target "10" new businesses in FY96. Others represent new "companies" in the early development stage - all are in their infancy. If the companies evolve successfully, they will become candidates for FY97's "target" businesses. In establishing "fully operational" status, we evaluated the condition of the company against a set of ten criteria dealing with their business and marketing plans, facilities and equipment, management, staffing, financing, product status, and sales. If 75% or more of the criteria are satisfied, the business is considered fully operational.

New Businesses in Tri-Cities Area

- 1.* KLM Analytical uses x-ray fluorescence to provide economical, rapid analysis of a wide variety of samples, including water, paint, and glass. The Richland company was assisted through Pacific Northwest National Laboratory's Entrepreneurial Leave of Absence (EntLOA) program. A major contribution was the transfer of equipment from the Laboratory, and the Richland and Sequim laboratories have provided samples for analysis, thus serving as the first customers.
- 2.* Integrated Environmental Technologies utilizes its award-winning technology for plasma electroconversion to convert a variety of waste streams into a nonhazardous, usable, glass product and a useful combustible gas. The company was started through the Laboratory's EntLOA program and the technology was licensed from Battelle.
3. Alligator Corporation serves the environmental industry by commercializing selected PNNL technologies through partnerships with dominant firms in waste minimization and pollution prevention. The Richland company was started through PNNL's Entrepreneurial Leave program, and Battelle licensed its technology for conversion of wet biomass to methane to Alligator Corp. PNNL is also providing technical assistance.
4. Infometrics, Incorporated commercializes software for public education and to assist small businesses in understanding and fulfilling their regulatory reporting requirements. The company will develop information-based software and provide software development services to other companies. The Richland-based firm was started through PNNL's Entrepreneurial Leave program.
5. BetaScint, Incorporated provides fiber-optic-based radiation sensors for sale or hire in support of environmental restoration, treaty verification, and routine monitoring activities throughout the world. The company was started through the Laboratory's EntLOA program. BetaScint has obtained a license from Battelle and the Laboratory is helping identify markets and locate potential local partners and financial resources.
- 6.* XL Sci-Tech, Incorporated is developing a new bone-like structural material made of calcium phosphate glass for commercialization. The new material is eventually absorbed by the human body and thus could eliminate the need to remove metal plates and pins inserted previously to repair broken bones. The company was started through the Laboratory's EntLOA program, although the technology was developed before the inventor was employed by the Laboratory. No Laboratory owned intellectual property is involved. XL SciTech was awarded a Small Business Innovative Research grant. A CRADA with the Laboratory was signed and is underway to continue the development and testing of this new material. The Laboratory is also providing technical assistance and has loaned equipment to the new firm.
- 7.* Valley Vine Machinery Company is a new firm created through the Laboratory's EntLOA program. The company recently had two mechanical grape pruners fabricated at a machine shop in Prosser, WA. ABCD has worked with VVM by providing national design/manufacturing safety standards and guidelines. ABCD has also introduced VVM to Byron Equipment Company, who could have a more significant role in manufacturing the mechanical pruner. WSU-TC business students performed market assessments for this device, and a summer intern developed a pricing strategy for the pruner.

8. Earth Sports Products, Inc. is marketing two sports products in the Tri-Cities. The Mountainboard and TrailSkate will allow "boarders" and "skaters" to negotiate trails through hilly or mountainous terrain. The company was started through the EDO's Office of Small Business Programs. The TrailSkate's creator has moved to the Tri-Cities from Tacoma to help manufacture and market the device and to be near the technical resources of the Laboratory. The off-road skateboards are manufactured under contract in Minnesota. The off-road in-line skates will be manufactured in the Tri-Cities, if possible, early in 1997. Technical assistance was completed to select optimum materials for the skates. The TrailSkate part of the business is now separate from Earth Sports and will continue as an independent business in the Tri-Cities.
9. SARE, Inc. will develop, manufacture and market energy efficient systems, emission control devices, and improve safety equipment for motorcycles. The company is located in Kennewick, WA and opened its doors May 26. SARE was created by merging two existing small businesses.
- 10.* Mobility Engineering Company is a new start-up that will design, fabricate, test, and commercialize human powered off-road vehicles for use by disabled individuals. Two prototype vehicles were designed and are currently being fabricated: a snow pod and a trail chair. A market assessment of the snow pod and trail chair was completed by Lionel Joyce and Associates. An attractive market was identified. Mobility Engineering also received an SBIR grant to develop and test their devices, which will assist youth and adults in overcoming their disabilities.
- 11.* Bonanza Ag Exchange/Apple Valley is a new start-up company manufacturing and marketing a new "horse treat." This product has natural apple or carrot flavoring and a complete vitamin mix; it is used as a training aid or special treat for horses. ABCD was instrumental in putting the partners together and funding a trial production run of product for test marketing.
- 12.* ACJ/SARAD commercializes radiation/radon monitoring and mitigation products. Started by a former Laboratory scientist, Tony James; recent partnership with German entrepreneur, SARAD, accesses their technologies. Also, will serve as manufacturing outlet for selected Laboratory instrumentation. We have provided support on market opportunities, financing options, equipment - the Laboratory's walk-in environmental chamber, and space.
- 13.* PureSource is developing an inexpensive, effective nitrate removal kit for use with home drinking-water systems. Pacific Northwest's Entrepreneurial Leave Program and the Agri-Business Commercialization and Development Center helped launch the new company, which plans to manufacture the product in its Tri-Cities office.
- 14.* Virion Technology is developing a patch for treating selected skin diseases. The Lab is assisting with the prototype and stability studies under technical assistance and a quick-response CRADA that gains Virion access to expertise in chemical compatibility, packaging design, and materials fabrication that Virion does not yet possess. The Laboratory also designed manufacturing techniques and methods for large-batch production to enable transition to clinical trials--the last step to official acceptance by the Food and Drug Administration and the medical community.
- 15.* Zess Engineering and Environmental Sciences, Inc. plans to make commercial refrigeration and air-conditioning systems more efficient. This business, located in western Washington, recently opened an office in the Tri Cities. The firm is using the Lab's expertise in micro technology to increase energy efficiency of refrigeration systems. Support is being provided by the U.S. Department of Energy and Washington. Through EDO's Technical Assistance and Entrepreneurial programs, the Lab provided funding for materials and staff time to demonstrate the technology at the 331 building. The firm plans to establish a manufacturing facility in the Tri-Cities. The Lab holds a joint patent with Zess, and has provided a demonstration site.

Grouping by Economic Cluster and Linkage to the EDO Program

Environmental Services*KLM Analytical ⁽²⁾*Integrated Environmental Technologies ^(1,2)*AC James/SARAD ⁽²⁾*PureSource ^(1,2)Agriculture*Valley Vine Machinery ^(1,2,4)*Bonanza Ag/Apple Valley ^(2,4)Health/Medical Products*SL Sci-Tech, Inc. ^(1,2,3)*Mobility Engineering ^(1,2)*Virion ^(2,3)Energy Products*Zess Engineering ^(2,3)

(1) Entrepreneurial Leave of Absence

(2) Technical Assistance Program (TAP)

(3) CRADA

(4) ABCD

Survey of Local Business Partners on Value of Assistance**Results**

Virtually all of the partners (97%) would recommend the Laboratory's technical assistance to others, and 95% would use it again themselves. Among those who received recommendations from the Laboratory's technical assistance, 85% either have implemented, or plan to implement, the recommendations.

Analysis

The Laboratory provided technical assistance to 82 firms this fiscal year, 49 of which are local small businesses. From this assistance, we identified four solid opportunities to develop local manufacturing operations in:

- recreational products (1)
- energy products (2), and
- drug delivery (1).

The Laboratory regularly receives positive responses to our support for small business and are part of the local area's small business support structure. For example, we served on the organizing committee of the 1996 Small Business Week Celebrations and have organized workshops and a "trade show." As a result of the popularity of the Technical Assistance Program, funds from DOE-ER ran out before year-end, but we were successful in obtaining a 3161 grant from TRIDEC to continue technical assistance locally for at least two more years.

Mail surveys were sent to the 66 firms that had completed technical assistance in FY96. The surveys, designed to be completed in 10 minutes or less, consisted of 16 questions on 2 pages. Out of the surveys sent, 42 of them (64%) were filled out and returned.

Almost all of the scores were higher in this year's survey than in last year's, but the differences were not significant. One notable improvement is in timeliness of providing technical assistance. Ninety-five percent (95%) of the respondents were satisfied or better this year. This percentage is nearly 20% better than last year.

In addition to the jobs already created, respondents stated that if ongoing product development efforts are successful, over a hundred local jobs will be created over the next 3 to 5 years. It is clear from this survey and other sources that the results (such as job creation) of economic development efforts typically occur years after action is taken.

The mean score for all responses to the first six questions combined was 4.6 out of 5. Ninety-three percent (93%) of the respondents were satisfied or better with their relationship with the Laboratory. Ninety-two percent (92%) of the respondents were satisfied or better with EDO's level of performance. Ninety-five percent (95%) of the respondents were satisfied or better with the interaction process of the Technical Assistance Program. Ninety-two percent (92%) of the respondents were satisfied or better with the timeliness of getting technical assistance set up. Ninety-five percent (95%) of the respondents were satisfied or better with the timeliness of receiving technical assistance. Ninety-two (92%) of the respondents were satisfied or better with the usefulness of the technical assistance provided.

Survey of Local Economic Development Organizations

Results

All seven of the primary local economic development organizations and many of the secondary organizations are extremely familiar with efforts and programs of the Economic Development Office (EDO). Efforts in FY96 have expanded awareness to those that were previously unaware or had limited knowledge.

Analysis

In January, the Laboratory identified the Tri-Cities branch of Washington State University (WSU-TC) as well-suited to assess how the EDO was viewed by its principal stakeholders in the local economic development community. An ethnographic survey instrument was developed by Dr. Pam Henderson and her students in the WSU-TC MBA program and an initial survey was completed in May. A "familiarity diagram" was prepared categorizing the respondents into one of three groups based upon their knowledge of the EDO: 1) detailed knowledge, 2) limited knowledge or awareness, and 3) unaware.

The intent of this assessment was to identify areas in which the EDO might seek to improve interactions with and its perceptions by the economic development entities of the Tri-Cities region. In light of the initial survey results, EDO staff proactively sought opportunities to work with a broader number of entities, including those who had no knowledge of EDO activities and to improve their understanding.

Late this year, a followup assessment was undertaken by the lead analyst on the initial assessment. Figure 6.1 summarizes the results of both surveys. The results were every positive. Even at the time of the initial survey, all seven of the primary stakeholders possessed detailed knowledge about the EDO. One striking finding of the year-end assessment is the dramatic increase in the level of awareness of the four organizations previously unaware of us. Only one remains (the City of West Richland) and they felt responsible for their lack of knowledge.

Figure 6.1

Summary of Assessment Results, Elvina T. Jeffers, graduate student, WSU-TC MBA Program.

"Economic development stakeholders in the Tri-Cities perceive Battelle as an organization that has put down roots in the community. Levels of awareness about the [EDO] among the 19 secondary stakeholders, though relatively high when last measured, have risen dramatically. In addition, the seven primary stakeholders awareness of the EDO is high, with 100% of them aware of the office and several or all of the EDO's programs. Over 70% of them feel they have a good working relationship with the EDO. They describe the [EDO] staff as professional, helpful, and easy to work with. Although several members of the primary group often failed to distinguish between Battelle, the EDO, and Hanford related businesses, inroads have been made by the [EDO] with organizations that consider themselves to be "non-Hanford". The efforts of the [EDO] are perceived as ending the site's lip-service to economic development. All organizations from this group of seven that have had the opportunity to work closely with someone from the EDO regarded their interaction as a positive experience."

Economic Development Critical Outcome Performance Rating

The overall performance rating for this outcome is determined by comparing the sum of the effectiveness scores of the contingency functions to the following rating scale.

ELEMENT	Results	Effectiveness Score
6. Economic Development		
6.1 Create technology-based business growth in Tri-Cities		
6.2 Help outside companies and local companies generate first/new sales in the Hanford "market"		
6.2.1 Impact of PNL assistance on company employment	Completed	10
6.2.2 Number of new businesses started in the area	10	100
6.2.3 Survey of local business partners on the value of assistance	93%	65
6.2.4 Survey of local economic development organizations	95%+	60
Total Performance Points		235

Total Score	212 - 231	111 - 211	(-79) - 110	(-300) - (-80)	<(-301)
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

INTEGRATED ASSESSMENT PROGRAM

Summary

We believe that our overall performance rating for the Integrated Assessment Program is Excellent. The Laboratory's approach is comprehensive, fully responsive to DOE's contract reform principles of performance-based management, well integrated with the Laboratory's business planning process, and fully supportive of the needs of the business. The deployment of the Integrated Assessment Program has several strengths, but also some weaknesses. Evidence of senior management involvement is strong within the all six pilot organizations but has not been deployed uniformly throughout all of these organizations. While there are no significant gaps in deployment of the basic requirements, the level of understanding of how to effectively use more contemporary methods of assessment to drive improvement is still immature. There is considerable demonstration of the immediate use of assessment information to correct near-term problems. However, few organizations are demonstrating the use of assessment information in a more cross-cutting, or holistic manner to identify higher level issues associated with the effectiveness of systems. In addition, the lab-level information generated as part of the annual performance evaluation process is not well synchronized with the annual business planning process. A more complete description and self-evaluation of the Integrated Assessment Program is contained the formal report PNNL-11380, *Pacific Northwest National Laboratory, FY96 Evaluation of Integrated Assessment Program*. The following is a brief overview of that document and addresses approach, deployment and use of results.

Approach

The implementation of the Integrated Assessment Program marked the beginning of the Laboratory's effort to move away from the traditional auditing methods and toward the more contemporary concepts of measuring organizational performance through self-assessments.

Although delays were experienced in completing the full development of the Laboratory-level assessment planning process, the key components of the planning process were defined and used in FY96 and then modified completed in time for development of the FY97 assessment plans. This process aligns Laboratory assessment activities with business objectives, and is being integrated into the Laboratory's business planning process and DOE's appraisal process. Key components of the assessment planning process include:

- Use of a common framework of performance categories. This assures that attention is given to critical areas of business performance, and that consistency in presenting and analyzing information is maintained throughout the Laboratory.
- Alignment with the Laboratory's critical outcomes and individual division/directorate business objectives for the fiscal year being planned. This assures that assessment activities are focused in areas that enable the achievement of the organization's objectives.
- Integration of the Independent Oversight and Internal Audit assessment activities to avoid redundancies and enhance efficiency and effectiveness.
- Continual involvement of customers and stakeholders in the development of objectives and assessment activities as well as in the monitoring of progress.

While FY96 was a pilot year for the Integrated Assessment Program, full implementation of the assessment planning process for FY97 business planning began in May 1996. This included: the Laboratory standards which define the processes; the organizational functions that will administer the processes; and the definition of the various Laboratory roles and responsibilities.

The Integrated Assessment Program is used by the Laboratory and its Divisions and Directorates to measure organizational performance and includes the following dimensions.

Establishing Performance Objectives and Indicators

Through the business planning process, Division/Directorate management teams develop organizational performance objectives and indicators to support the accomplishment of Laboratory critical outcomes and Division/Directorate business results. A laboratory procedure and suggested guidelines is used to develop the objectives and indicators. This procedure ensures that performance objectives and indicators are in alignment with, and support, the achievement of the critical outcomes and the desired business results of the individual Divisions/Directorates.

Monitoring and Reporting Progress towards Achievement of Laboratory Critical Outcomes through the Development of Assessment Plans and Conducting Self-Assessments

Once organizational performance objectives and indicators are established, an assessment plan is developed by the Division/Directorate. This plan outlines the assessments the organization believes necessary to monitor progress toward, and ensure achievement of, outcomes and objectives. Key customers and stakeholders are typically involved in the development of assessment plans that include both internal and external assessments. Internal assessments are those conducted by the Division/Directorate and Laboratory internal oversight organizations. External assessments are those conducted by organizations outside of the Laboratory, i.e., oversight organizations, regulatory agencies, etc.

Division/Directorate assessment plans are also used to develop the Laboratory's Assessment Plan. This plan represents a consolidation of Division/Directorate plans. A copy of the Laboratory-level assessment plan is provided to DOE-RL. The Quality Director uses the assessment plan to: (1) increase effectiveness and efficiency by integrating assessments to avoid redundancies and planning assessments in all critical business performance categories, and (2) demonstrating to internal and external oversight organizations, and to customers, actions being taken to monitor and improve performance, including compliance.

Determining Performance Strengths, Weaknesses, and Issues Impacting Achievement of the Critical Outcomes through Evaluation of Assessment Results

Once assessment plans are developed, assessments are conducted throughout the year and their results used to monitor, evaluate, and report performance quarterly.

Identifying Top Improvement Actions Based on Performance Strengths, Weaknesses, and Issues, and Factoring these Actions into Business Planning

Assessment results are evaluated semi-annually by each Division/Directorate to (1) determine progress towards accomplishment of Division/Directorate objectives and Laboratory Critical Outcomes, and (2) identify performance strengths, weaknesses, and issues impacting achievement of objectives and outcomes. Performance strengths, weaknesses, and issues, are determined by evaluating assessment results using the Malcolm Baldrige-based evaluation criteria. On an annual basis, each Division/Directorate prepares a report discussing progress and issues. The information from these reports is used to determine and communicate to the Laboratory and DOE-RL, overall Laboratory progress towards accomplishment of the Critical Outcomes and performance strengths, weaknesses, and issues impacting their achievement. The information is also used at the Division/Directorate and Laboratory levels to determine top improvement actions for business planning.

We believe the Laboratory's approach is comprehensive, fully responsive to DOE's contract reform principles of performance-based management, well integrated with the Laboratory's business planning process, and fully supportive of the needs of the business and therefore deserves an Outstanding performance rating on this dimension.

Deployment

A two-phased deployment of the approach described above is underway. In the first phase, FY96, focus was on establishing the organizational infrastructure and processes. The key organizational infrastructure that was established was the Independent Oversight organization, reporting to the Director, ES&H. This function has been staffed with very senior, highly qualified staff. The primary responsibility for this function will be the validation of the overall effectiveness of the Laboratory and Division/Directorate self-assessment efforts. In addition, this organization will conduct special studies and investigations on key issues identified by management. This latter item was the primary activity during phase one of deployment since the overall self-assessment effort was in the early stages of development and implementation.

The Integrated Assessment Program design, and agreement to conduct a pilot, came about as a result of a Laboratory and DOE-RL workshop in January 1996. Laboratory-wide deployment of the Integrated Assessment Program, phase two, began in May 1996 with the start of the FY97 business planning cycle.

The approach was piloted in six Divisions/Directorates in FY96 and included:

- Environmental Technology Division
- Energy Division
- Facilities and Operations Directorate
- Environmental, Safety, and Health Directorate
- Finance Directorate
- Environmental Molecular Sciences Laboratory

Their assessment plans (1) linked assessments to Critical Outcomes and Division/Directorate business results and objectives, (2) planned assessments in performance areas in addition to the compliance area, and (3) integrated assessments with those being conducted by other oversight organizations.

The other major aspect of the first phase was the development of the assessment program processes and systems including the approach to self-assessment to be implemented by the line organizations. Teams of laboratory staff developed key assessment processes and procedures. These processes have been deployed through the Laboratory's Standard-Based Management System and include:

Integrated Assessment, which addresses:

- establishing organizational performance objectives and indicators
- planning assessments
- monitoring, evaluating, and reporting performance
- conducting operational assessments
- identifying and implementing improvements

Operational Assessments, which addresses:

- planning, performing, analyzing and closing assessments

Independent Oversight, which addresses:

- developing annual oversight plan
- interfacing and followup with independent audits

Internal Audit, which address the same topics as Independent Oversight.

As mentioned briefly under the Scientific Excellence and Productivity Critical Outcome earlier in this report, the Laboratory has made good progress in formalizing its peer review process. While peer review has always been an element of the Laboratory's management approach, more emphasis, including the establishment of Division-level Review Committees made up of external experts is being pursued.

We believe the deployment of the Integrated Assessment Program has several strengths, but also some weaknesses. Evidence of senior management involvement is strong within the all six pilot organizations but has not been deployed uniformly throughout all of these organizations. While there are no significant gaps in deployment of the basic requirements, the level of understanding of how to effectively use more contemporary methods of assessment to drive improvement is still immature. Therefore, for this dimension we believe a performance rating of Good is warranted.

Use of Results

Since this is the first year of implementation, this is the weakest aspect of the program, yet there are some key positives.

First of all, the Laboratory has benefited from the establishment of what are called "critical outcomes" and associated performance objectives and indicators. These objectives and indicators have helped to focus the efforts of the Laboratory, provided clear articulation of expected levels of performance, and established a Laboratory-level framework for monitoring progress.

Second, the organizations that have participated in the pilot have broadened their self-assessment activities to address performance areas other than just compliance. Results from self-assessments in such areas as customer focus, business and operational results, and process management have led to several improvements at the Division/Directorate level.

Third, the Independent Oversight and Internal Audit organizations have conducted several investigations that have helped identify significant issues for the Laboratory. These issues are being addressed either through existing improvement initiatives (e.g. the Operational Improvement Program) or dealt with on a case-by-case basis.

Finally, as mentioned previously strong internal peer reviews have resulted in several high quality proposals that were eventually funded as part of several new DOE scientific and technology initiatives.

The organization is just beginning to utilize the information generated from the Integrated Assessment Program in a holistic way. As the program matures in FY97 strong progress in terms of analyzing and understanding the assessment information so that strategic improvement initiatives can be planned and executed will be expected.

We believe a performance rating of Good is appropriate with respect to the Laboratory's use of results. There is considerable demonstration of the immediate use of assessment information to correct near-term problems. However, few organizations are demonstrating the use of assessment information in a more cross-cutting, or holistic manner to identify higher level issues associated with the effectiveness of systems. In addition, the lab-level information generated as part of the annual performance evaluation process is still somewhat out of synch with the annual business planning process.

DETERMINING THE LABORATORY PERFORMANCE RATING

The Laboratory's performance evaluation in FY96 consists of two key elements. The first element, weighted at 75%, reflects the Laboratory's progress toward accomplishment of the critical outcomes. The second element, weighted at 25%, reflects the quality of the Laboratory's efforts at implementing the pilot Integrated Assessment Program and continuously improving performance. The following series of tables provide the summary information necessary to calculate the Laboratory's overall performance rating.

COMPOSITE CRITICAL OUTCOME SUMMARY

Critical Outcome	Rating	Value	Weight	Score
1. EMSL	Outstanding	5	25%	125
2. Environmental Management	Outstanding	5	20%	100
3. Scientific Excellence & Productivity	Outstanding	5	20%	100
4. ES&H/Conduct of Operations	Excellent	4	20%	80
5. Leadership	Excellent	4	10%	40
6. Economic Development	Outstanding	5	5%	25
Total Score				470

Total Score	500 - 450	449 - 350	349 - 250	249 - 149	<149
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

COMPOSITE SELF-EVALUATION SUMMARY

Self-Appraisal Element	Rating	Value	Weight	Score
1. Approach	Outstanding	5	50%	250
2. Deployment	Good	3	30%	90
3. Results	Good	3	20%	60
Total Score				400

Total Score	500 - 450	449 - 350	349 - 250	249 - 150	<149
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

OVERALL FY96 PNNL PERFORMANCE EVALUATION

Performance Component	Rating	Value	Weight	Score
Critical Outcome Performance	Outstanding	5	75%	375
Self-Assessment Program	Excellent	4	25%	100
Total Score			100%	475

Total Score	500 - 450	449 - 350	349 - 250	249 - 150	<149
Final Rating	Outstanding	Excellent	Good	Marginal	Unsatisfactory

PERFORMANCE BASED INCENTIVES**Facility Transition Performance Incentive**

Summary - Progress towards accomplishing this Performance Objective exceeded our expectations. As a result of a concerted laboratory-wide effort, 34 of the 39 facilities in this performance incentive are now in "standby". Progress significantly exceeded the baseline schedule as shown in Figure 1, *PNNL Facility Transition Performance Incentive Graph*.

Figure 1

39 facilities were originally in the scope for placing in standby during FY 96 and 97. 34 of these facilities were placed in standby. Of the five remaining facilities:

- two were determined to have a continuing mission and removed from the list,
- two mobile offices were occupied with no economical alternative to vacate at this time, and
- one facility (306W) could not be vacated without significant adverse impact to the programs operating in

the facility, and was modified to greatly reduce utility costs and allow economical short term occupancy.

Results and Analysis - This year a total of 34 facilities in the scope of this performance incentive were placed in standby, with a resulting FY96 and 97 projected cost avoidance of \$3,600,000, and a sustained annual cost avoidance of \$2,100,000. Two additional facilities that were not in the original incentive scope, 6652H and I, were also placed in standby with sustained annual cost avoidance of \$45,000. There were no plans for shutdown of these facilities when the original facility transition scope was established, but when R&D occupants indicated that the facilities could be vacated the effort was supported and shutdown accomplished. Even though 306W could not be shut down due to programmatic impact, a significant cost avoidance was realized by modifying the ventilation system to eliminate most of the Aonce through@ ventilation and dispose of the requirement for steam heat, for a cost savings in facility operations of approximately \$250,000 per year. This modification cost approximately \$260,000 to implement and will allow for economical facility use for an additional 5 years. While the cost savings realized from the additional facilities and 306W ventilation modification does not count toward the incentive, it has resulted in a cost savings for PNNL and the government.

The facility transition effort eliminated a significant legacy of excess material and waste, disposing over 112 tons of low level waste and in excess of 1500 hazardous waste individual items from the transitioning facilities. This material was moved in a controlled compliant manner. Ecology performed an inspection of 314 Building during the shutdown of the facility, and found no problems with the transition effort even though the facility had in excess of 1000 individual containers of hazardous waste that were being managed as part of the shutdown.

325 Downgrade Performance Incentive

Summary

Progress towards accomplishing this Performance Objective is meeting our expectations. The major items identified for moving 325 towards the Category III inventory status have been accomplished.

- Known radionuclide inventory with the conservative potential to contribute to an accident has been reduced by a factor of approximately 16, with current known facility inventory at only 120% of the Category III inventory limits.
- NDA of the facility was accomplished this fiscal year, at a cost of less than \$75,000.
- A rigorous effort was accomplished to characterize the contents of the tanks in and adjacent to the facility. The original estimate for completing the characterization of these tanks was in excess of \$2,000,000 using conventional intrusive characterization techniques. A Scientist Engineer Emeritus completed this review using an alternative technique of rigorously researching and utilizing operational and historical data in conjunction with intrusive sampling to accomplish the task for less than \$20,000.
- An administrative control system has been developed and implemented that provides for facility management control of facility inventory.

The original Contract Performance Measure needed clarification. While the intent was for the document to provide specific facility inventory limits, this was not clearly stated nor was the specific mechanism for establishing the limit stated. The clarification was jointly worked between DOE-RL and PNNL and is as follows: "Rewrite and submit for approval the 325 Building Category II Safety Analysis Report, AND establish and implement administrative controls for the 325 Building nuclear material inventory." Verbal concurrence was received in this clarification, and written confirmation has been requested. Additional information is provided in the Results and Analysis section below.

The decision to downgrade the 325 Building to a Category III predated the decision to terminate operations in the 324 and 327 Buildings. Following a careful analysis of the Hanford and National requirements for a facility of this type, it became apparent that the Hanford cleanup mission alone would potentially not be supported to the extent necessary for an accelerated cleanup if the 325 Building were downgraded to a Category III Hazard Class Facility without having 324 and 327 Buildings available. Accordingly, a PNNL 325 Building operations strategy and basis have been prepared and are being approved for submittal to RL.

Results and Analysis

325 Building known radionuclide inventory with the conservative potential to contribute to an accident has been reduced by a factor of approximately 16, with current known facility inventory at only 120% of the Category III inventory limits. The following tasks required for inventory reduction were accomplished this year:

- Waste Pu grouted and shipped
- A SrF capsule was shipped to PUREX
- An AmCm Capsule transferred to 327 building
- A Nordan capsule shipped to 324 building
- Pu238 has been repackaged into DOT Type B containers removing it from the facility inventory

NDA of the facility was accomplished this fiscal year, at a cost of less than \$75,000. The resulting process weighted estimate of facility holdup is 24 Pu239 Dose Equivalent Curies.

A rigorous effort was accomplished to characterize the contents of the many tanks in and adjacent to the facility. The original estimate for completing the characterization of these tanks was in excess of \$2,000,000. A Scientist Engineer Emeritus completed this review using alternative, but completely acceptable techniques for less than \$20,000. The heels in the tanks account for 32% of Category III inventory limits.

The tank characterization effort revealed an unexpected inventory of material in TK14, a 10 gallon tank located in the HLRF B cell. To obtain access to the tank, the cleanout effort for the cell had to be completed (19 waste drums loaded and shipped), and a portion of the cell floor pan removed. The contents of the tank were removed and sampled. On 10/9/96, a potential issue was identified where if Am and a complexing agent were in the tank, it could have through radiolysis over many years have precipitated as an oxalate. It is possible that an oxalate precipitate would not be detected by the methods used to assure the tank was empty. This issue will be investigated further in FY97. There are no other tanks known to exist in the facility that jeopardize our efforts to achieve a Category III known radioactive material inventory.

An administrative control system has been developed and implemented that provides for facility management control of facility inventory.

The original Contract Performance Measure linked to Incentive for 325 Downgrade included the following Basis for Measurement, "Rewrite and submit for approval the 325 Building Safety Analysis Report." This needed clarification since while the intent was for the document to provide specific facility inventory limits, it was not clearly stated nor was the specific mechanism for establishing the limit stated. The clarification was jointly worked between DOE-RL (Craig Richins) and PNNL (Mario Bagaglio, Tonia Graham, and John Bumgardner). A mutually acceptable interpretation of the basis for measurement was reached, and is as follows: "Rewrite and submit for approval the 325 Building Category II Safety Analysis Report, AND establish and implement administrative controls for the 325 Building nuclear material inventory." Verbal concurrence was received in this clarification, and written confirmation has been requested. Advantages of this approach include substantially reducing the costs associated with the writing and review of a Category

III SAR. Rewriting the SAR would entail mostly removal of sections which would require little effort, but the approval cycle is very manpower intensive for RL. Since a Cat II SAR was submitted and approved this year, little is to be gained by resubmitting the entire SAR. Instead, the new CAT II SAR will be used "as is" with the facility radionuclide inventory minimized by strict administrative controls.

324 B-Cell Clean Out Project

PNNL successfully completed the shipment of all Mixed and Special Case Waste scheduled for storage in the Purex Tunnel Facility by the extended date of June 8, 1996. The incentive milestone for completing the integrated baseline plan to support an expedited completion date of December 1998 was met on April 15, 1996 as scheduled and DOE-RL approved the supporting change request to implement the modified plan.

The incentive fee milestone for expediting the completion of the project was impacted by the requirement to meet constrained shipping dates to Purex. PNNL's efforts to institute three shift operations was delayed to meet the reduced schedule for shipping waste to Purex and a formal request for a no penalty extension to the incentive fee milestone was requested and approved by DOE-RL. Per DOE's approval the milestone was modified from 5/1/96 to 6/17/96 and the revised date was met.

PNNL continued efforts to relocate spent fuel bundles to 400 area ISA however, this incentive fee milestone was not completed. Insurmountable delays were encountered in the preparation of safety documentation supporting the acquisition of the storage cask and their placement at the FFTF ISA.

High Level Vault Tank Liquid Waste Removal

PNNL's incentive Fee milestone for completion of processing by 8/23/96 was not met as scheduled. The TPA milestone, M-89-01 requiring completion by October 31, 1996 was actually completed ahead of schedule on September 5, 1996 and a letter advising the Washington State Department of Ecology of this completion was issued by DOE-RL on September 30, 1996. Due to ALARA and personnel exposure concerns PNNL requested, and DOE-RL approved, a modification to the incentive milestone basis for measurement on this project. Specifically, RL agreed to delete the measurement associated with removing the ion exchange columns from D-Cell and placing them in B-Cell by 9/30/96. At this time the ion exchange columns are in D-Cell and will remain there until their disposal in late FY97.

324 Cesium Capsule

PNNL continued to provide support to DOE in an effort to determine the best available option for disposition of the CsCl Capsule and miscellaneous powder and Pellets. Funding was provided for a subcontract to confirm the PNNL supplemental Options Study. Additionally, DOE-RL provided revised guidance on September 30, 1996 outlining their preferred path forward. PNNL with assistance from WHC initiated actions in accordance with verbal guidance provided by DOE-RL. Based on these early actions three shipping casks, which could feasibly be used to relocate the capsules and CsCl material, were identified and technical evaluations are continuing.

APPENDIX A

Peer Review Summaries

Summaries of the external FY96 Peer Reviews for six Pacific Northwest National Laboratory research programs are attached.

Title

Free Radical Chemistry of Coal Program

Medical Technologies Program

Chemical Physics Program

Effective Separations Program

Tank Focus Area Program

Material Sciences Research Program

Results of the Environmental Molecular Sciences Laboratory (EMSL) peer reviews are found under the EMSL Critical Outcome.

**Peer Review
FY-1996
Basic Energy Sciences - Chemical Sciences
Free Radical Chemistry of Coal Program**

Review Scope

The Free Radicals in coal Research Program at PNNL was reviewed on February 29 - March 1, 1996 by Professor John Larsen, Lehigh University. This program is funded by the Molecular Processes branch of BES Chemical Sciences Division in the Office of Energy Research. Dr. Robert Beyerlien, DOE-HQ Program Manager also participated in the peer review. The review covered the work of five principal investigators who engaged in a wide variety of experimental and theoretical studies studying free radical chemistry that is important in the maturation of coal and the conversion of the more useful energy or chemical feedstocks.

Summary of Results

This peer review clearly recognized the quality and productivity of research conducted under our Free Radical Chemistry Coal research program. The groups work studying radical hydrogen transfer reactions was cited as being, "fundamentally important in establishing the limitations of hydrogen transfer mechanisms that are much more stringent than supposed by many workers in the field". Professor Larsen states, "the individuals in the group are being used in a way that maximize their strengths". This speaks well of the leadership of Jim Franz.

There were two key points from Professor Larsen's review that will shape the groups future research. First, Dr. Larsen pointed out that the free radical chemistry research under this program is important to other areas such as environmental chemistry, biological oxidation pathways and organic geochemistry. Second he feels that ways need to be found to support the entire efforts of the group (current funding is 3.5 FTE's) such that they are not diverted into many desperate areas.

Response to Review

The results of this peer review and subsequent discussions with BES-Chemical Sciences program managers have led to the decision to shift the focus of the group's research away from coal chemistry. BES Chemical Sciences is greatly reducing their coal chemistry program over the next two years. For example, In FY97 major program reductions in funding at both Argonne and Oak Ridge National Laboratories have been initiated. There was no reduction in the level of effort in the PNNL coal program in recognition the high quality and productivity of the science and recognition of the importance of free radical chemistry to other key DOE missions.

We have committed over the next two years to the completion of several projects (i.e. complete research in selected areas and publish the results) and initiation of new free radical chemistry research projects in areas important to environmental chemistry and chemical process relevant to industry (e.g, catalysis)

In early FY-1997 we will develop a plan to redirect the research of this group and initiate discussions with HQ program manager's with the goal of having new research projects in place by FY-1998.

**Peer Review
FY-1996
Medical Technology**

Review Scope

On June 5 and 6, 1996, a review of the emerging Medical Technology program was held with a panel comprised of seven participants from government, industry, and academia. Attendees included physicians from the Public Health Service and from a major medical school, CEOs from a medical device and a biotechnology company, a representative of a major pharmaceutical company, a manager of a health care technology venture fund. The group's technical background included ultrasound, biotechnology, medical diagnostics and therapeutics, and business.. The review was to held to seek external comment on the relevance of our technical base to significant medical issues and on our business strategy.

Summary of Results

The principle conclusion of the external reviewers was a validation of Medical Technology as viable program for the Laboratory based on our capabilities and the national needs in this area. The review panel indicated that the Laboratory has huge technological resources that are relevant to addressing significant medical issues. Their comments and suggestions reflect both the great opportunity and the challenges we face as we seek to mature this program. Some of the specific recommendations were to

1. **Aggregate the Technology Portfolio into Larger "Baskets".** These larger "baskets" will help to identify where we need to develop capability or strategic alliances and provide a clearer basis for differentiating ourselves.
2. **Get Some Early Wins.** Move potential early winners forward at an aggressive pace to establish our credibility with clinicians and recognition for ourselves in the market. These early wins would demonstrate that we can provide "medical applications with a proven clinical benefit that provide a value added" in health care.
3. **Actively Manage the Intellectual Property.** Nurture an appreciation for the importance of intellectual property among the technical staff. It was suggested that we would need to make sure that our culture encouraged and rewarded entrepreneurial behavior in order to realize these potentially significant returns.
4. **Build Strategic Alliances.** We were encouraged to build our capability portfolio through smart alliances and partnerships. Of particular importance are linkages with clinicians to identify R&D needs and to be partners for us in joint research proposals as well as performers of clinical trials required for FDA approval.

Response to Review

Some of the actions taken since the review include:

1. We've narrowed our focus to areas where we believe we can differentiate ourselves: Medical Materials, Targeted Therapeutics [Immunoconjugates and Microbiosystems], Diagnostic Systems [Ultrasound and Selective Sensors], and Health Care Systems [Patient and Physician Information Systems]. FY97 LDRD activities have been aligned to build long-term, laboratory assets in areas that will underpin these thrusts. Specifically, capability development will focus on building the Biomaterials Science and Engineering Laboratory, MicroBiosystems Laboratory, and the Real-Time Diagnostics competency. We need to continue to revisit these focus areas as we gain additional understanding of needs and mature the program.

2. We have delivered early successes in externally funded programs. One of the most important of these is the MUSTPAC-1 [Medical Ultrasound, Three-dimensional and Portable with Advance Communications] system developed for DARPA in collaboration with a physician at Madigan Army Medical Center. This prototype system was field test in Bosnia in August and has generated excitement both inside and outside DoD. The MUSTPAC will be featured in future programs by the Armed Forces Network and the Discovery Channel and has been identified as one of a handful of key technologies to be featured in the Army Surgeon General's booth at an upcoming DoD conference. Other significant prototype systems and proof-of-principle experiments have been completed in the informatics and materials area. We need to continue to focus on product delivery and build our track record of accomplishment.
3. We are working with all of the staff conducting internal or external medical technology projects to identify and manage the intellectual property in a way that will provide the greatest opportunities for local economic development. We are currently working on business plans for four potential new ventures and expect to have at least one of these ready to launch this fiscal year.
4. The MOU that we have with Madigan Army Medical Center is an example of the type of strategic relationships we need with clinical sites. We are in the process of developing an MOU with the Medical University of South Carolina and we are building a relationship with the University of Washington and the Fred Hutchinson Cancer Center. We have also identified a list of 10 other important institutions that we need to begin to cultivate as research and clinical partners. We've also developed relationships with physicians within the local community. For example, we are working with Enrique Carter, M.D. to conduct initial field testing of a prototype breath analysis device for detection of H. Pylori and we are working with Northwest Orthopedics [Louis Zirkel, M.D.] to provide expert advice on computing, sensing, and communications technology that can be built into the new same-day surgery to enable remote patient monitoring and distance learning. In addition, Dr. Zirkel has been providing us with a physician's perspectives on many of the bone tissue repair and replacement technologies that we are developing.

**Peer Review
FY-1996
Basic Energy Sciences - Chemical Sciences
Chemical Physics Program**

Review Scope

Review of Pacific Northwest National Laboratory's program, Chemical Physics sponsored by Basic Energy Sciences (BES) - Chemical Sciences was held February 26-28, 1996 in Richland, Washington. Three external reviewers from academia, (University of Utah, University of Georgia, and Wayne State University) and one reviewer from Sandia National Laboratory reviewed approximately 50% of the experimental and theoretical chemical physics projects at the Lab. This review is part of a continuing cycle of reviews such that each project receives peer review every two to three years.

Summary of Results

This was a excellent peer review. There was recognition of the high quality of the science at PNNL and the relevance of the science to Environmental Molecular Science Laboratory's (EMSL) mission to develop fundamental molecular-level understanding of chemistry in environmentally important phases and interfaces. The national and international reputation of several of our scientist in this program was also recognized.

General statements conclude that the staff and the research they performed are excellent. One reviewer states, "Overall quality of the research performed by these eight scientists is excellent". Specific comments on individual researchers support these more general statements. In reference to Thom Dunning a reviewer states, "The basis set project carried out by Dr. Dunning provides a valuable resource to the entire Quantum Chemistry Community. Dunning is a recognized world-wide leader". Another reviewer noted that the development of fundamental theoretical methods "has led to research of the highest quality and impact in the theoretical community". The research in separations science is reported as being, "particularly relevant to the EMSL's mission, since separating ions will be needed for the environmental cleanup." There were several references to the unique aspects of the research under this program such as, "Dr. Steve Sharp's experimental systems provide a spectroscopic capability which to my knowledge is unique".

The peer review group recognized that an important feature of the research programs at PNNL that distinguishes them from academic research programs is the need for integration to address complex problems relevant to DOE missions. As stated in one report on the Chemical Physics Program, "The collaborative way is necessary to achieve a molecular-level understanding of fundamental chemical processes related to EMSL's mission". However the report goes on to state that more progress is needed in this area.

Response to Review

- A The reviewers noted that Steve Sharp was being diluted by many demands upon his time and recommended more focus for his work. He was faced with to different options, focus on fundamental chemical physics research or on technology development and applications of his capabilities to more applied research problems. His interests and success in the technology development arena have caused him to choose this as his main focus. Hence, he is establishing a new role for himself within the EMSL; to help provide a bridge from the more fundamental EMSL work to the applied elements of PNNL and to attract collaborators to the EMSL by providing unique, state-of-the-art capabilities. In this role he has established numerous collaborations and has helped raise over \$1M in new funding for PNNL in FY97.

- B. The reviewers recommended that Lai-Sheng Wang find ways to obtain more quantitative information about the important systems that he was studying. This will take time to adjust or build new capabilities but a proposal has been developed and is under review. Dr. Wang continues to build strong ties with theorists as recommended.
- C. Doug Ray's work was seen as on the verge of "taking off" and in need of additional publications. The dismantling of his complex equipment and its move to the EMSL will delay this happening. To counter this problem he is continuing and strengthening his collaborations with outside collaborators.
- D. It was recognized by the peer review panel that many of the individual researchers in the Molecular Theory Group need to develop stronger coupling to other relevant research programs, particularly experimental ones in the EMSL. Substantial effort has been invested recently towards developing a more integrated and collaborative research environment in the Molecular Theory Group with increased outreach to other research programs. As an example, a new research project was initiated this year with the Environmental Dynamics & Simulation Program in the EMSL.

**Peer Review
FY-1996
Effective Separations Program (ESP)**

Review Scope

Six PNNL tasks in the Efficient Separations and Processing (ESP) Crosscutting Program (DOE/EM-53) were reviewed by the ESP's technical review team during April. The review team consisted of eight members of the ESP core management team (staff from DOE/HQ, PNNL, ORNL, SRTC, WPI/Gaithersburg, SAIC/Gaithersburg, and BDM/Gaithersburg), four representatives from three of DOE/EM's four "focus areas" (tanks, mixed waste, subsurface contaminants), five experts retired from ORNL, ANL, SRTC, DOE/ER, and PNNL), and four university professors.

Summary of Results

The characteristics of the tasks most important to reviewers were the programmatic and technical situations being addressed by the tasks and if and how the tasks should be funded to address them. In this context the six PNNL programs are characterized as follows:

- (a) two tasks remain in the ESP mainstream (Garrett Brown, Dean Kurath)
- (b) one is task very well respected but thought to be near the boundary with the EM Science Program (Ben Hay)
- (c) one task is well respected but is addressing a problem that recently decreased in priority (Tim Hubler) and hence will be closed out after FY97 (Tim Hubler)
- (d) one task is addressing a problem where the domain of applicability is challenged by some in the EM focus area to which the work was originally directed (Mike Lilga)
- (e) one task was recommended for termination because reviewers remained unconvinced of the technical viability after two years (Dave Nelson)

Typically, the PNNL tasks were praised for technical content, management, technical expertise, and laboratory capabilities, but not particularly for meeting high priority EM needs. PNNL has a good reputation for adapting to reviewer comments, which has translated into redirection of some work into areas of increasing priority to ESP. The cost of doing work through PNNL has not been a problem.

PNNL should continue to draw upon its familiarity with and expertise regarding Hanford site problems. There should be an emphasis on identifying technical problems that will remain important irrespective of changes in EM programs or Hanford site management or technical philosophy, as opposed to trying to follow changing baseline strategies as a means of justifying tasks. Specifically, PNNL should promote information exchange between scientist/engineers interested in or working on separations and those participating in Hanford tank characterization activities, with emphasis on understanding the speciation of radioactive elements and the reactivity, or lack thereof, of soluble complexes or of nominally insoluble solids.

Response to Review

Dave Nelson--Separation of HTO Using Membranes. The main area of contention from the peer review was the decision not to continue funding of Dave Nelson's task on a membrane for separating tritium from water (HTO from H₂O). Reviewers were not convinced that the proof-of-principle has been established and hence were reluctant to follow the task plan into testing and commercialization phases. There is sufficient interest at the Hanford site for PNNL to look for funding outside of the ESP program to continue the work, and some of this work should in fact be devoted to thoroughly establishing the repeatable performance of

the membrane. Therefore, a plan is being developed to pursue this work under the EM Science Program to understand the exact cause of the HTO/H₂O separations that has been repeatedly observed and yet difficult to reproduce in polyphosphazene membranes. A proposal will be submitted in the next EMSP Request for Applications (RFA).

Mike Lilga--Electrically Switched Ion Exchange. This involves electrically switched ion exchange based on nickel ferrocyanide/ferricyanide ion exchange of cesium. Reviewers took issue with the acceptable domain of pH. Some in the Tank Focus Area (TFA) know that potassium cobalt hexacyanoferrate degrades in pH above 12 and assume all such systems are guilty by association. Mike has noted that he will electrochemically generate essentially cesium nickel ferri/ferrocyanide, and that the pH stability of this is much better than the sodium or potassium forms. Resolving this difference will be the main focus of Mike's work this year. In addition, Mike will develop new research projects under this task base on input from scientists interested in electrically responsive organic structures that can be bonded to surfaces -- e.g. ferricenes and enzymatic compounds.

Garrett Brown--Test Sorbents; Industrial Contracts. Review comments were not contentious. We are continuing to follow the existing plan in the TTP.

Dean Kurath--Salt Splitting Using Ceramic Membranes. Review comments were not contentious, but did emphasize the need to test the technology using actual tank waste supernatant as soon as possible. Dean is pursuing to access to such waste for testing either in 325 building or by collaborating with staff at 222-S.

Ben Hay--Ligand Modeling and Design. Review comments were quite positive, and recommended that Ben move from alkali metals and other symmetric ions to consider RCRA metals and actinides. Accordingly, Ben submitted and won an EMSP proposal to study F-block elements. Therefore, in FY97 Ben will utilize EMSP funds to pursue the more fundamental, basic aspects of ligand modeling and design and use ESP funds to test new concepts on more applied problems.

**Peer Review
FY-1996
Tank Focus Area**

Review Scope

On March 19-21, 1996, the Tanks Focus Area (TFA) FY96 Midyear Review occurred in Richland, Washington. This is the main, yearly technical review of the projects under the auspices of the TFA. The review is conducted by the TFA Technical Review Group (TRG). The group is composed of 14 engineers and scientists from academia, industry, and other laboratories who are nationally recognized for their expertise in tank remediation. The TRG is organized into five subgroups: Members-at-Large, Characterization, Retrieval and Closure, Pretreatment, and Immobilization, and is led by Wally Schulz, a world-class authority on nuclear chemical separations and waste disposal technology. The TRG ensures that the technologies being developed have a sound technical basis.

The following projects led by Pacific Northwest National Laboratory were reviewed:

- Laser Ablation/Mass Spectroscopy (LA/MS)
- Retrieval Process Development and Enhancements (RPD&E)
- Alternative Alkaline Washes of Hanford Sludges
- Crossflow Filtration Testing on Hanford Wastes
- Technetium Removal Studies
- Cesium Removal Tests with Actual Hanford Supernates.

Summary of Results

Overall, the TRG was quite pleased with the progress made on Pacific Northwest National Laboratory led projects. On the LA/MS, the TRG stated "This is an excellent technology development effort with high likelihood for significant impact in several aspects of the tanks program and beyond. The technical work appears to be of high quality." The TRG recommended that continued support be provided after deployment. The RPD&E project is working on several technologies (i.e., scarifier, Pulsair, particle size probe, extendible nozzle, borehole miner) to retrieve tank wastes. The group commented that "End effector tasks appear to be well defined and . . . obviously producing valuable results." The TRG noted concerns about deployment feasibility on the Pulsair and particle size probe technologies. Issues about the interfaces between the components and transport system were also noted. On the sludge washing technology, the TRG suggested studies on settling, gel formation, and leaching. On the crossflow filtration, the TRG stated that the solid-liquid separation program to evaluate crossflow filtration and other equipment is well integrated to provide design input for processes. They also commented that life-cycle issues should be integrated into the studies early and recommended more communication between the involved organizations. The information on the oxidation state of technetium in Hanford tank wastes was very preliminary. The TRG wants to expand and accelerate studies regarding the understanding and removal of technetium species from the waste. On the cesium removal technology, the TRG was " . . . quite pleased with the progress of the final screening and flow testing of candidate sorbents." The TRG asked about conducting large-scale flow tests and the possibility of a hands-on maintenance low-level waste (LLW) vitrification facility based on the data and experience obtained.

Response to Review

The TFA has discussed the comments with the Technical Team and the Technology Integration Managers. The comments were formatted into a report, and responses were drafted by the appropriate staff. This information will be published as a Pacific Northwest National Laboratory report when the final review is completed. For the LA/MS, technology transfer will be supported through FY98, after that, the user will need to purchase further support. On the RPD&E, most of the technical comments are being addressed through directing the TRG to past studies or conducting new studies. The project staff will continue to resolve deployment issues. For sludge washing, the

technical comments were accepted and studies are in place or being planned. Monthly telecons have been arranged to ensure timely discussion and debate about the separation technical issues, including crossflow filtration. On technetium removal technologies, most of the comments were accepted and work is being done, including new work being sponsored by the Efficient Separations Crosscutting program. This work was established in direct response to these comments. On cesium removal, scaling up to large-scale flow tests was deferred and the TFA will evaluate the possibility of a LLW vitrification facility.

**Peer Review
FY-1996
Basic Energy Sciences - Materials Sciences
Materials Sciences Research Program**

Review Scope

A review of PNNL's projects on mechanical properties and radiation effects of metals and ceramics, which are funded by DOE/BES Division of Materials Sciences, was held August 29-30, 1996. The outside reviewers were Prof. Glenn E. Lucas, University of California/Santa Barbara, and Dr. Terence E. Mitchell, Los Alamos National Laboratory. Drs. John N. Mundy and Yok Chen, DOE/BES Division of Materials Sciences (Germantown), also attended.

Annual project reviews are required by the Office of Basic Energy Sciences. However, after last year's extensive review, it was agreed that an in-depth review should be held every third year with half of the projects each reviewed in the intervening years. One advantage is that this allows more time to be focused on each project in the intervening years. This year the following projects were reviewed:

- Interfacial Dynamics During Heterogeneous Deformation
- Interfacial Deformation Mechanisms in Aluminum Alloys
- Irradiation-Assisted Stress Corrosion Cracking
- Fundamental Studies of Stress Corrosion and Corrosion Fatigue Mechanisms
- High-Temperature Properties of Joined Ceramic Matrix Composites
- Environmental Degradation Mechanisms in Lightweight Transportation Alloys (new)
- Irradiation Effects in Ceramics

The purpose of the annual reviews is to (1) provide constructive suggestions/criticism regarding the research and research agendas, and (2) make suggestions for necessary modifications in program directions.

Summary of Results

Reviewers were impressed by the overall quality of the research funded by BES. The reviewers noted:

- PNNL researchers have developed excellent linkages between basic and applied aspects of the various projects as well as between their experimental and theoretical components. The programs interconnect not only with one another but also with other programs both inside and outside PNNL.
- External collaborators are well chosen. The diversity of these collaborations—industry, other labs, universities—combine to strengthen these projects.
- Equipment is first-rate and conducive to performance of high-quality experimental work. Researchers have put together state-of-the-art, often unique experimental facilities with a modest investment of equipment funds.
- Funding has been combined with other sources to get a whole that is greater than the sum of its parts, resulting in an effective mix of applied and basic research. Specific problems are being solved in the short term while sustaining long-term basic research. Problems are being approached with an appropriate mix of experimental, analytical, and computational tools.

Response to Review

This review was held in late August and only within the past week have we received reviewer comments and recommendations. Below is a summary of the reviewer recommendations. In the near future, we will formulate plans to respond to the reviewers comments and suggestions.

Interfacial Dynamics During Heterogeneous Deformation: Suggested that (1) atomistic grain boundary

sliding models should more explicitly incorporate the effects of temperature; (2) Cavitation modeling/experiments should put more focus on nucleation at grain boundary precipitates.

Irradiation-Assisted Stress Corrosion Cracking: Although program directions seem appropriate, there appear to be some opportunities to bring some atomistic modeling into the mix of tools. The variation of segregation/depletion with distance along the grain boundary, and why these variations persist, warrants more attention.

Fundamental Studies of Stress Corrosion and Corrosion Fatigue Mechanisms: Might be worthwhile to use analytical TEM to measure thickness and composition of the interface interphase.

Irradiation Effects in Ceramics: Although the Principal Investigator is a highly interactive and cooperative person, interactions are mostly external; appears to be little interaction between this program and related ones at PNNL (e.g., SiC/SiC work) which could prove beneficial. Funding should be increased to prevent project from falling below critical size; the neutron irradiation studies as well as ion irradiation studies are very important—but also very expensive. Several experiments are in jeopardy of being terminated early due to lack of funds.