Final Draft
Assessment of Some Opportunities for Reducing the Long-term Stewardship Mortgage at Brookhaven National Laboratory

April 29, 2002

Prepared for

DOE-CH Long-Term Stewardship Pilot Project
Planning Critical Elements of the Transition to Long-term Stewardship
At Chicago Operations Facilities

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List of Abbreviations and Acronyms

BAO	DOE-Brookhaven Area Office
BGRR	Brookhaven Graphite Research Reactor
BNL	Brookhaven National Laboratory
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
CEGPA	Community, Education, Government & Public Affairs
CH	Chicago Operations Office
D&D	Decontamination and Demolition
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
EIMS	Environmental Information Management System
EM	Environmental Management Directorate
EMS	Environmental Management System
ERD	Environmental Restoration Division
ES&H	Environment Safety & Health
ESD	Environmental Services Division
E&O	Engineering & Operation
FTE	Full-time Equivalent
FUA	Facility Use Agreement
FY	Fiscal Year
GIS	Geographical Information System
GW	Groundwater
IAG	Interagency Agreement
ISO	International Standards Organization
LTS	Long-term Stewardship
LTSIP	Long-term Stewardship Implementation Plan
LU/IC	Land Use/Institutional Control
MOU	Memorandum of Agreement
PC	Personal Computer
PE	Plant Engineering
P2	Pollution Prevention
O&M	Operations and Maintenance
QAP	Quality Assurance Plan
RadCon	Radiological Control Division
RI/FS	Remedial Investigation/Feasibility Study
ROI	Return on Investment
SBMS	Standards Based Management System
SC	DOE Office of Science
S&M	Surveillance & Monitoring
SOP	Standard Operating Procedure
VOC	Volatile Organic Compound
USEPA	U.S. Department of Environmental Protection
$K	thousands of dollars
$M	millions of dollars

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Summary
The purpose of this assessment was to identify ways that science and technology can be applied to Long Term Stewardship (LTS) requirements to reduce cost and the residual risk and uncertainty. Most of Brookhaven National Laboratory's (Brookhaven) projected LTS costs are for remediating groundwater and the associated support activities. Therefore, this assessment focused on three related areas: groundwater monitoring, land use control management, and information management.

Three initiatives to improve groundwater monitoring are discussed. They are integrating the groundwater organization and processes, demonstrating and adopting a low-flow purge method for sampling groundwater monitoring wells, and applying a site-specific "data quality objective" evaluation to the groundwater monitoring program. These initiatives generated significant, measurable cost savings while improving the program's quality.

Integrating LTS responsibilities into existing Laboratory operational programs is an important goal of LTS transition planning. Such integration was applied to the recent Environmental Protection Agency's (EPA's) requirement for a Land Use Control Plan. The approach to developing this "living" plan is discussed; the EPA preliminarily accepted it. It provides a good example of the value in integrating LTS responsibilities into existing programs.

Information management is expected to represent about 10% of the Brookhaven LTS costs. As part of this Pilot Project, Brookhaven reassessed its information needs, the performance of existing information management systems (some of which are under development), and assessed the potential value of more web-based information management applications. The Laboratory concluded that the existing information management system could support LTS, but that better web-based applications in certain situations could provide real benefits. Also, it was concluded that not all web applications would be cost effective. Therefore, a phased approach to implementation was recommended. That way, the potential value and performance of each application could be assessed. It also would allow flexibility in adapting to fluctuating funding levels. Web-based applications that should be developed in the near term include mapping the location and status of waste areas, land use controls, and historical radiological releases and spills. Other future applications could include a groundwater cleanup index tool, and enhancement of the Brookhaven Buildings application.

1.0 Background

The Department of Energy's Office of Environmental Management (EM) soon will be completing its current clean-up mission at Brookhaven. Based on the approved EM Baseline, this mission could be completed by FY 2006 or sooner. However, uncertainties in funding could

extend its completion by up to five years. Once the mission is finished, the EM would like to turn over the responsibility for managing the site (long-term stewardship, or LTS) to the Program Secretarial Office (PSO) responsible for the site.

At Brookhaven, all EM cleanup work is being performed under the CERCLA regulatory framework, specifically a Federal Facility Agreement under CERCLA section 120 (also called the Interagency Agreement [IAG]). This complex but unified process addresses many of the elements necessary for LTS. For example, the IAG contains requirements for retaining records, transferring property, public participation, and a Five Year Review process to ensure that the remedies continue to protect the public's health and the environment.

The DOE Chicago Operations Office (CH) identified the scope of, and estimated costs in each site's life-cycle baseline for long-term surveillance, treatment, and maintenance, as appropriate. However, other key elements of long-term stewardship may not yet be as fully developed, or may not be codified in a manner to facilitate discussions between Program Secretarial Officers (PSOs) or with external stakeholders. CH intends to address key elements on stewardship for its sites by drafting Long- term Stewardship Implementation Plans (LTSIPs) using a graded approach (e.g., by narrowing the focus onto elements identified in the draft LTSIP guidance, thereby directly tailoring the draft LTSIPs to the expected conditions at each site). Elements that may require clarification or more elaboration include information management [archiving, updating, analyzing, retrieving, disseminating], appropriate levels of stakeholders' interactions, planning land use control, and methods and approaches to reducing the costs of LTS compliance and the residual risk and uncertainty.

This document summarizes some of our experiences, ongoing inititiatives, and discussions about opportunities to reduce the LTS mortgage. Section 2 defines the purpose of this task; Section 3 gives some information on the types of costs expected at Brookhaven for various LTS work; and, Section 4 describes the assessment of three opportunities for mortgage reduction that also may be applicable to other DOE sites with LTS responsibilities.

2.0 Purpose

The purpose of this work was to identify ways that science and technology can be brought to bear on LTS requirements to reduce both the costs of compliance and the residual risk and uncertainty. To assist in this process, Brookhaven's resources, as part of the LTS Planning Pilot Project, were tasked to use their experience in LTS decision analysis, information management, monitoring, optimization, and technology.

3.0 LTS Cost Component Analysis

Highlights

- 95% of the forecasted LTS costs from FY06-FY10 are for groundwater remediation
- Some projects may not have been fully captured LTS in the EM Baseline

This analysis was undertaken to ensure that the initial assessment of opportunities for mortgage reduction was focused on the most costly impact areas. It also provides a high level interim determination of the LTS scope and estimated costs in each of the major EM programs.

Figure 1 breaks down the LTS costs for FY06 through FY10 by program/project. These forecasts were updated and validated in July 2001. This itemization helps to identify priority areas for

developing opportunities for reducing the mortgage. Groundwater Projects and the Sitewide Program (Sitewide) account for 95% of the LTS mortgage during this period. Our efforts need to be focused in these areas.

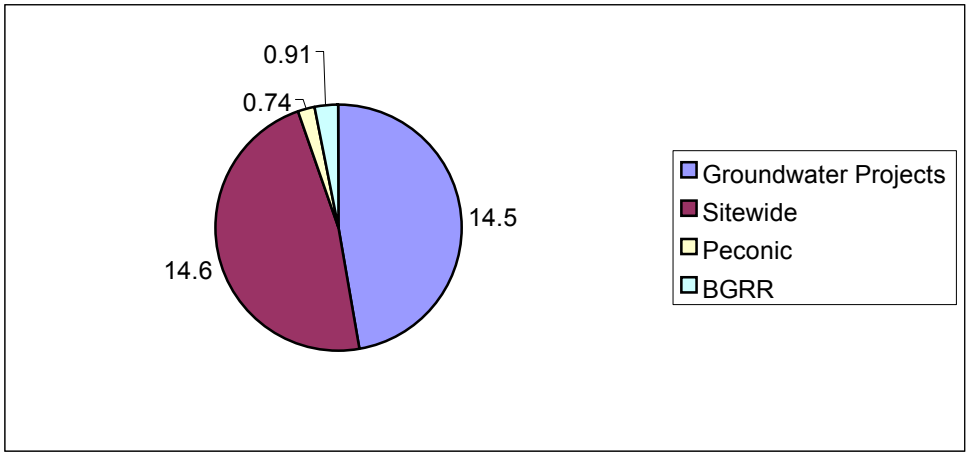

Figure 1. LTS Costs by Program for FY06-FY10 ($M) . Note: The costs for BGRR and the Peconic River are likely incomplete as no Record of Decision has been reached.

The scope and cost of the Sitewide program is broken down further as follows:

- Groundwater monitoring
- Reporting/Modeling
- Environmental Information Management System (EIMS)
- Project/Program Management

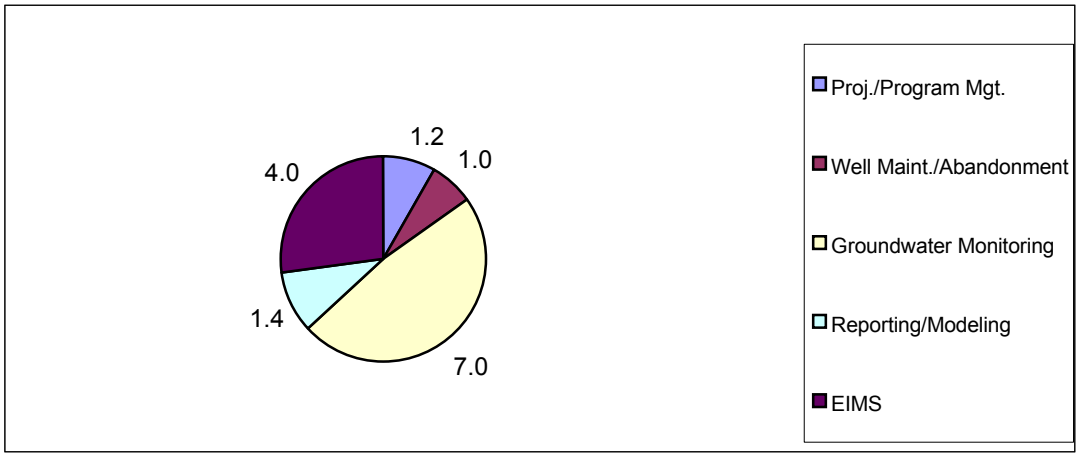

Figure 2. LTS Costs for the Sitewide Project for FY06-FY10 ($M)

The scope and cost of the Groundwater projects are further subdivided:

- Treatment plant O&M – This includes system operation, maintenance, utilities, material, and labor. There will be 17 treatment plants with a combined capacity of approximately 4500 gallons per minute (gpm).

- Landfill O&M- There are no costs for landfill O&M in the EM baseline for FY06 and beyond. Landfill O&M is required through 2027.

- Management/Field Engineering – This includes the costs of managers and field engineering staff for the groundwater remediation system project with some minor costs for contractor support. These personnel are responsible for determining cleanup performance, adapting cleanup systems to changing conditions, maintaining cost-effectiveness, and fulfilling the remediation exit strategy.

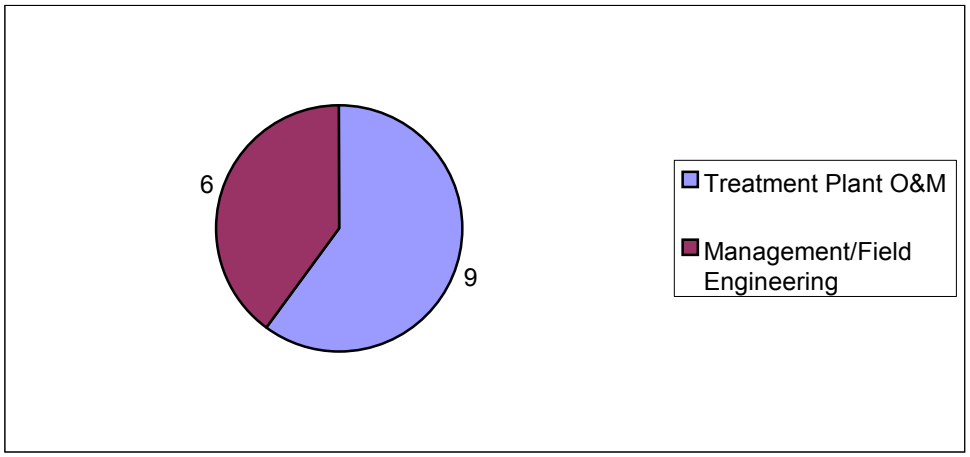

Figure 3. LTS Costs for "Groundwater Projects" - FY06-FY10 ($M)

We did not examine the LTS cost for the Brookhaven Graphite Research Reactor (BGRR) and the Peconic River because they currently represent a relatively small fraction of the projected overall costs between FY06 and FY10 and are likely incomplete as no Record of Decision has been reached.

From this analysis of the projected LTS costs, we identified four areas with potential for improving the processes and reducing the mortgage. They are discussed below.

The cost component analysis also suggests that the scope and costs of LTS given in the EM Baseline may be incomplete. Therefore, before developing the LTS Plan, the LTS elements of the work packages' scope of work, costs, and schedule should be reviewed carefully to ensure that they are complete; any necessary revisions should be made. The following areas came to the attention of the team:

- O&M for the three landfills
- Peconic River (not yet defined as no ROD has been signed)
- BGRR (not yet defined as no ROD has been signed)

4.0 Brookhaven's Initiatives to Reduce the LTS Mortgage

This section describes the assessment of three opportunities for mortgage reduction. These same opportunities may be applicable to other DOE sites with LTS responsibilities. The areas for improvement were selected on their overall contribution to projected LTS costs at Brookhaven, and their applicability to other Chicago Operations Facilities.

- Groundwater monitoring
- Development Strategy- Land Use Control Management Plan
- Assessment of LTS Information Needs and the Potential for Web-based Applications

4.1 Groundwater Monitoring

Brookhaven is taking several major steps to improve its expanding groundwater monitoring program to increase its value, reduce risks to human health and the environment, and control costs. The groundwater monitoring program encompasses 31 projects, plus quarterly monitoring of groundwater elevations. Eighteen of these are environmental restoration projects that entailed 2,180 separate sampling events at 563 wells during calendar year 2000 (CY2001 data are still being summarized). The remaining 13 projects involve environmental surveillance of active research- and support-facilities. During CY2000, 350 samples were collected from 125 wells for these projects.

In addition, EM is planning to construct eight additional groundwater treatment systems between 2002 and 2006, with additional monitoring wells for them.

The population of groundwater monitoring wells at Brookhaven increased significantly over the years (**Figure 4)**. The majority of the growth was due to the characterization work supporting the RI/FS phase of the cleanup.

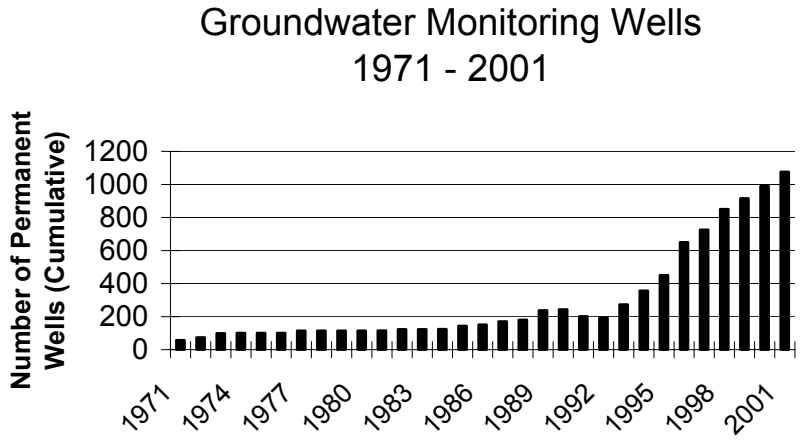

Figure 4. The increase in the number of permanent groundwater monitoring wells at Brookhaven

The Sitewide project, which includes groundwater monitoring and data management, make up nearly 50% of the LTS costs in the first five years. The number of groundwater samples collected each year drives these costs. **Figure 5** illustrates the the number of samples collected from these groundwater monitoring wells. According to the plan, more wells will be installed for the next few years, and then the numbers will gradually decrease as cleanup goals are reached.

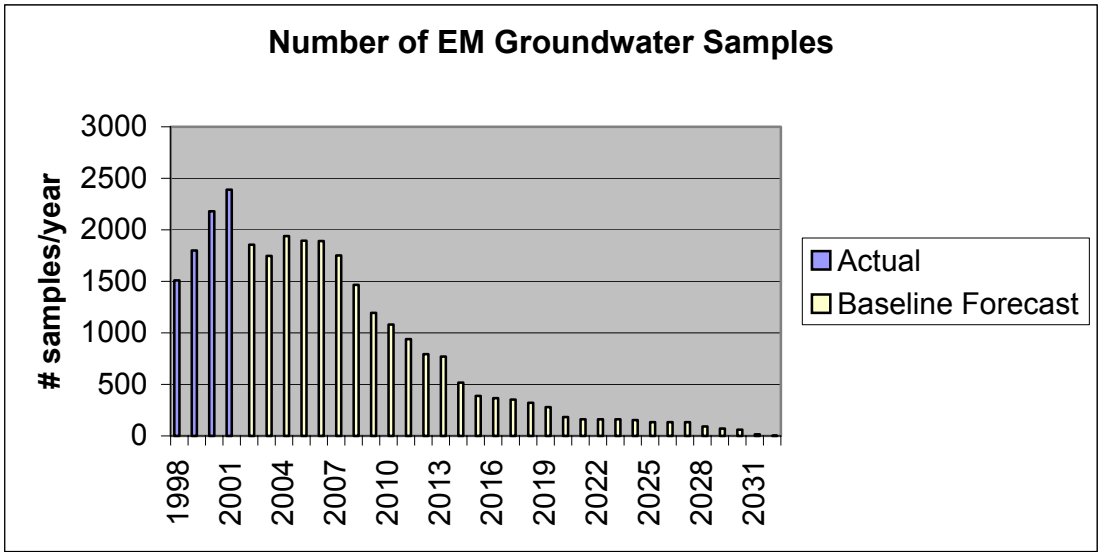

Figure 5. The number of groundwater samples collected per year by Brookhaven's EM program.

Highlights

- Integration of the groundwater program has improved communication on technical- and stakeholder-issues.
- Tangible cost savings have yet to be realized.
- Another phase of integration is recommended as part of the LTS transition.
- All the groundwater "management" resources should be in one group to improve efficiencies and quality.
- The mix of skills for future actions will focus less on engineering and construction, and more on assessing cleanup performance and maintaining optimization.

The improvements to groundwater monitoring are focused in three core areas: program integration, methods for low-flow purge, and program review using a site-specific data quality objective process. Each of these is discussed below.

4.1.1 Integrating Groundwater Management

Starting in 1999, Brookhaven took several steps to ensure that the groundwater surveillance and restoration programs were integrated. Incorporating all sampling and analysis of groundwater into one program offers benefits both in planning and implementing the groundwater monitoring program. Laboratory-wide integration of groundwater data management and services were designed to improve the program's efficiency and cost-effectiveness. This initiative on integration was established via a Groundwater Protection Implementation and Integration Plan (http://www.bnl.gov/esd/GPMP_files/GPIIP2000.pdf). Brookhaven and PNNL/Hanford are believed to be the only DOE sites with an integrated groundwater program. The other sites typically have separate groundwater organizations for cleanup and environmental compliance.

A central part of this blending was the integration of two

Oracle-based databases: the environmental surveillance (ES&H) database and the groundwater restoration Environmental Information Management System (EIMS). The ES&H system contained data from environmental surveillance monitoring programs conducted under DOE Order 5400.1 and other environmental regulatory requirements (e.g., permit-required reporting). The EIMS contains sub-surface monitoring data to support the CERCLA program (including groundwater data, remediation-system performance data, well construction, and geologic data). EIMS support includes visualization, modeling, and graphics functions. The integration was achieved in the following phases:

I. Phase 1: The 1998 and newly generated groundwater data were combined into one database, using the EIMS as the platform. These data are accessible to all groundwater staff for evaluating and reporting. During this phase, the ES&H database operated in parallel;

II. Phase 2: The data from the other environmental media monitoring programs (e.g., air, surface water) were integrated into the EIMS database. The ES&H Division's database was "frozen" in time, functioning as a historical database until the EIMS database became fully operational;

III. Phase 3: Organizational changes needed to support the integrated program were evaluated. The historical data from the ES&H Division database will be imported into the EIMS database as needed; and

IV. Phase 4: The groundwater monitoring program was fully integrated in April 2000. Staff, equipment, and procedures were combined, based on decisions made in Phase 3, supporting all divisions and departments across The Laboratory.

Concurrent with the database integration, Brookhaven completed the following work:

1. Established and put in place a Sitewide Quality Assurance Program Plan (QAPP);

2. Set up consistent, Sitewide procedures for sampling (e.g., sampling methodology, disposition of purge water) and data handling (e.g., recording field measurements and logbooks);

3. Established Data Quality Objectives (DQOs) (see USEPA, 1994) for groundwater monitoring programs to ensure that the rationale for them is well understood and defined (installation of future wells, parameters sampled, and monitoring frequency), and that the programs for collecting the data meet the requirements and optimize the groundwater-monitoring network;

4. Instituted procedures, plans, and schedules for installing, maintaining, and abandoning wells;

5. Established uniformity in Brookhaven's vendor services (procurement, contracting, and electronic data delivery);

6. Formalized a peer-review process for environmental reports;

7. Incorporated non-CERCLA groundwater programs into ongoing and planned community relations activities, as appropriate;

8. Streamlined reporting on quarterly remediation system operations; and,

9. Implemented a Groundwater Protection Contingency Plan as a Laboratory-wide procedure to guide corrective actions and communication of off-normal groundwater quality results to senior management and stakeholders.

The net benefits of the groundwater program integration are

- Significantly improved internal- and external- communications
- Consistent communication on groundwater issues
- Streamlined reporting

We learned several lessons from our experience with this integration. The quality of service to The Laboratory has improved, although, to date, there have been no discernable tangible savings due to these changes in organizational structure. Brookhaven believes that its "unit operational costs" (e.g., sampling costs, labor costs) already are lean, based upon benchmark comparisons with other DOE sites. As the emphasis of the organization matures from engineering and construction to a focus on LTS, improvements in efficiency are expected. Several technical staff were transferred from the EM program to Environmental Services Division as part of the integration. However, groundwater remediation project managers were not reassigned. Consequently, two groundwater groups remain and resources are shared across organizational boundaries. We believe that all the resources for groundwater management should be in one group under one Division to reduce conflicting staff priorities and to promote better teamwork. For example, the technical approach to groundwater remediation work and reporting could still be better standardized across the Laboratory. The efficiency of reporting, its quality and cost-effectiveness could be improved by assigning these LTS responsibilities to one group. One further step in merging groundwater management should take place during the LTS transition.

This integrated groundwater group needs to encompass the right mix of skills for future actions that will focus less on engineering and construction, and more on assessing cleanup performance and communicating the findings to stakeholders. In addition, these resources should be concentrated on adapting systems to changing conditions, maintaining cost-effectiveness, and fulfilling the remediation exit strategy.

4.1.2 Methods of Low-flow Purge (http://www.bnl.gov/esd/docs/low_purge/low_purge.htm)

Highlights

- Achieved better quality data.
- Saved $250K/year in waste-disposal costs.
- Saved $175K/year in labor costs for sampling.
- Received P2 Award from BNL.

The removal of three to five well-casing volumes before sampling groundwater monitoring wells has been the industry's standard for many years. Recent research indicated that high-volume purging of monitoring wells before collecting samples might not be necessary to obtain data that are of sufficient quality for environmental monitoring and regulatory decision-making. To evaluate contaminant concentrations as a function of purge volume, 219 water samples were collected from twenty-one wells at multiple predetermined purge volumes, ranging from 0.05 casing volume (sufficient to purge the dedicated sample's pump- and discharge-line), up to the standard three-casing volumes. In ten of fifteen (67 percent) well-sampling events where one or more volatile organic compounds (VOCs) were detected at concentrations >5 µg/L, and in all seven events where tritium concentrations were >1,000 pCi/L, complete stabilization was achieved (i.e.,

concentrations were within ± 20 percent for three consecutive samples) after purging 0.05 to 0.25 casing volumes. However, in several cases, the initially stable VOC and tritium concentrations became more erratic as more water was flushed from the wells. These findings suggest that variations in the concentration of contaminants within a plume and the plume's position relative to a monitoring well's screen zone and sampling pump have a far greater effect on the observed concentrations than does the amount of water purged from a well before sampling.

The method of low-purge-volume sampling, used since April 1999, has reduced the volume of purge water by >92%. The lower volume of contaminated purge water requiring treatment, and the shorter time needed to sample the wells generated annual savings of $175,000 in the labor costs of sampling, and nearly $250,000 in waste management costs.

4.1.3 Program Review Using a Site-specific Data Quality Objective Process

Brookhaven and the DOE recognized that the groundwater monitoring program was growing at an increasing rate and was concerned that some data collected were not useful. We are committing significant resources well into the future for this monitoring. A comprehensive review of project-level O&M plans found inconsistent approaches to the design of groundwater monitoring programs across the various projects, and that they lacked sufficient detail to justify the objectives of monitoring and how the data are being used for decision- making.

Highlights

- Developed decision rules that form the basis of monitoring and the exit strategy.
- Linked data to decisions rather than just mapping.
- Standardized monitoring strategy across 31 projects.
- Developed a structured process with a maturing sophistication.
- Focused initially on "low hanging fruit".
- Invested $70K in supporting technical coaching.
- Projected cost savings of $345K for FY02. A secondary benefit is more focused reporting.

Starting in 2000, BNL used the Data Quality Objective (DQO) process to ensure that the groundwater data being collected are adequate and consistent with the monitoring objectives, are cost-effective, and that there are no significant gaps in the data that would inhibit decisions about adapting to changing conditions, the performance of remediation systems, and their termination. The DQO initiative was linked to a critical outcome for The Laboratory's performance evaluation system. This link was very significant in impelling thought and ideas into actions.

The DQO process is a scientifically based strategic-planning approach to prepare for data collection. It is an adaptable, yet systematic procedure for defining the criteria that a data collection program should satisfy, including collection schedules, sample locations, the number of samples to collect, the tolerable level of decision-error for the study, while acceptably balancing risk and cost. The DQO process also can be used to guard against committing resources to data collections that are not linked to the decision-making process.

In comparison to other DOE and DOD facilities, Brookhaven is spatially small and is situated in a relatively simple geological region, with a shallow groundwater table. Nevertheless, the density of monitoring points is relatively high compared to most facilities. Many permanent- and temporary-wells were installed to fulfill Brookhaven's objective of fully characterizing all contaminant plumes. This objective is driven by the need to restore groundwater quality in portions of the sole-source aquifer that was degraded by The Laboratory's historical waste management practices and operations, and protect it for future use by The Laboratory and its neighboring communities. We were able to meet this objective cost-

effectively because drilling costs are relatively low compared to other regions of the country owing to the shallow depth to groundwater and the unconsolidated aquifer materials. Brookhaven's data collection has resulted in an extensive on-site and off-site network of monitoring wells. Accordingly, rather little extrapolation, interpolation, and interpretation of the data are required to characterize and track contaminant plumes. Larger facilities must rely more on interpolating data and geostatistical analyses to characterize and track their contaminant plumes.

Brookhaven monitors its groundwater resources for the following reasons:

Surveillance

- Verify that operational- and engineered-controls effectively prevent groundwater contamination.
- Trigger early action and communication should the unexpected happen (e.g. control failure).

Restoration

- Track a dynamic groundwater cleanup problem when designing and constructing treatment systems.
- Measure the performance of the groundwater remediation efforts in achieving cleanup goals.
- Protect public health and the environment during the cleanup period

These purposes are driven by regulatory requirements, DOE Order, best management practice, and our commitment to environmental stewardship.

4.1.3.1 The Process

Because The Laboratory's groundwater monitoring program is extensive and complicated (31 diverse projects with approximately 690 active groundwater monitoring wells), we elected to divide implementation of the DQO Process into two phases. The first phase, the 2000 pilot study, formulated a site-specific methodology by classifying and standardizing projects and developed generic decision-rules for classes of projects. A key element in the pilot study was the assistance of outside experts in statistics and risk analysis that challenged us to increase our level of analytical sophistication, and brought in practical lessons learned from other DOD/DOE sites. As part of the pilot, DQO statements were prepared for three projects. The second phase of the project took place in 2001 and applied the DQO Process to the remaining ones.

Each monitoring project was assessed using the seven-step DQO process: 1) state the problem; 2) identify decisions; 3) identify inputs; 4) specify boundaries; 5) define decision-rules; 6) specify error tolerances; and, 7) optimize sample design. The development of generic decision-logic trees was of significant importance for each monitoring category. These are generic rules to aid groundwater-project managers in arriving at project-specific data-driven decisions that sustain repeatable and defensible decisions and actions. Brookhaven elected to use a rule-based system that is supported by simple statistical tests. Where statistical tests are invalid because of the failure of underlying assumptions, decisions rest upon expert knowledge of site operations and hydrogeology, in combination with statistical descriptions and spatial/temporal summaries of all relevant historical and recent groundwater measurements.

The following were the key elements in Brookhaven's approach:

- A Groundwater Protection Contingency Plan to assist in the identification of off-normal monitoring data.
- Extensive use of, and linkage with, groundwater models.
- Decision rules that form the basis of the monitoring and the system operation.
- Consideration of environmental factors, data trends, and the phase of a project.
- Acknowledgements that the rate of cleanup is inherently slow.
- A shift in thinking from mapping plumes to the decision processes and exit strategies.
- A structured process that did not rely on geostatistical analysis but captured obvious gaps in the data and unusable data.
- Potential geostatistic analysis of well redundancy and spatial optimization of future systems.

These DQO statements were incorporated into the annual *BNL Environmental Monitoring Plan (January 2002)*, which was submitted to the regulatory agencies.

4.1.3.2 Maintenance of the Process

In completing the DQO process, it was recognized that individual project DQOs should be updated as a project progresses or shifts phases. For example, when a groundwater remediation system goes from the pre-design characterization phase to the startup phase, and then to routine operation, the DQO should be changed to reflect a shift in the project's decisions and objectives. Brookhaven is committed to maintaining the groundwater DQO statements current.

4.1.3.3 Assessment of the Benefits

Brookhaven personnel primarily completed the Laboratory's DQO project, with help from subject-matter experts from several DOE facilities, and local environmental consultants. Completing this project cost approximately $95,000 over two years. Using the DQO process streamlined our development of comprehensive, standardized planning documents for all ER groundwater monitoring projects, thereby producing a technically defensible and cost-effective monitoring program. Compared to the original FY 02 EM Baseline, our review of the 16 Environmental Restoration projects using the DQO process reduced monitoring for 12 projects, increased it for two, and made no changes in two others. The net savings from this approach are approximately $340,000 for FY 02 alone. After detailing DQO statements for individual monitoring programs, we identified additional savings on a program-wide scale by reducing the amount of required documentation for each analytical data package submitted by contractor laboratories. This curtailment in paperwork will allow those laboratories to lower the per sample cost of analysis, with an estimated net savings to the ER groundwater monitoring program of $30,000 for FY02.

4.2 Development Strategy for Land Use Controls Management Plan

The U.S. Environmental Protection Agency (USEPA) requested The Laboratory to prepare a "Land Use Controls Management Plan" as a condition of the OU V Record of Decision. The maintenance of land use and institutional controls is a key element of a successful LTS program. Brookhaven currently does not have a system to manage this issue. Therefore, a strategy for the Plan was developed as part of the LTS Pilot Project.

There are several USEPA and DOE guidance documents on the subject; they are not prescriptive but performance-based. Brookhaven utilized this Pilot Project as a means of developing a strategy for setting up this important LTS element. The USEPA Region II office also pointed to some examples being elaborated at US Air Force facilities in New York (http://www.afbca.hq.af.mil/closeout). These examples, and the guidance documents gave us a framework, performance criteria, and some interesting approaches. The Pilot Project team held several internal workshops to formulate a cost-effective strategy suitable for The Laboratory and its stakeholder's needs.

The Team outlined the objectives of the plan:

- Satisfy requirements of Records of Decision (ROD) related to restrictions on land use.
- Define The Laboratory's systems for implementing, monitoring, and managing land use and institutional controls (LU/ICs).
- Ensure that LU/ICs requirements are captured.
- Ensure that LU/ICs requirements are properly considered in site operations.
- Preserve institutional knowledge for any potential future property transfer.
- Make information available for internal- and external-stakeholders (within security limits).
- Assist in articulating Brookhaven's commitment to long term stewardship.

The Team also offered several interesting observations on the EPA's request.

- EPA has guidance documents that outline how to implement land use and institutional controls; however, they are geared toward the DOD's Base Realignment and Closure (BRAC) issues where property is undergoing transfer. Brookhaven's Future Land Use Plan (1995) was developed to support the remedial decision process, stating that the Laboratory will remain under the DOE's control for at least the next 50 years.

Highlights

- USEPA and DOE guidance is geared toward sites transferring property.
- Brookhaven is an active research facility and does not intend to transfer its property in the foreseeable future. Therefore, a new site-specific approach was warranted.
- The plan's objectives will be satisfied via integrating existing systems (e.g., procedures, preventative maintenance, self-assessment, environmental management system) and improved web mapping.

- Brookhaven is an active research facility and does not intend to transfer its property in the foreseeable future. Therefore a new site-specific approach to LU/IC management is warranted.

- BNL needs a robust, credible process to capture requirements for land use and institutional control to ensure they are maintained and factored into site operations. This information must be available and current when the property is prepared for transfer. By centralizing this vital institutional knowledge, The Laboratory can assure the public of its commitment to environmental stewardship.

- The tool used to satisfy the objectives should not be a static document, but rather an integration of existing systems (procedures, preventative maintenance program, self - assessment program, environmental management system) with improved web-based

mapping. They should utilize a web-based information management application with decentralized data ownership but centralized access.

Through a series of working meetings, briefings with senior management, the following strategy was developed. It has been accepted by the USEPA.

The major elements that will be used to manage and maintain LU/ICs, and hence, satisfy the Plan requirements are

- Refine existing procedures to ensure that all necessary information is captured for management, and is properly considered in Site Operations.

- Improve on existing prototype Web-based information-management applications to facilitate useful access to the information (see section 4.3 more discussion).

- Identify the existing LU/ICs
    - The DOE maintains ownership of property-site security
    - Off-site easements for groundwater treatment systems and wells
    - Deed notification or restriction for future transfer
    - Facility Use Agreements
    - Source water protection constraints for on-site usage
    - Suffolk County Health (SCDHS) limits on private well permits
    - On-site delineation of compatible land use.
- Identify existing physical barriers (e.g., signs, fences).

- Identify points-of-contact for LU/ICs.

- Summarize Brookhaven /DOE's commitments in Memorandum of Understanding (MOU) (funding, advance notice of transfer, notification of problems)

- Continue periodic inspection/maintenance (existing preventative-maintenance system).

- Continue periodic evaluations (existing internal assessment system).

- Periodically evaluate and report the effectiveness of the controls in the Five-Year Reviews.

- Prepare a brief document stating the goal of the plan and outlining The Laboratory's use of existing processes, systems, and information management tools to satisfy the requirements of the Land Use Control Management Plan.

The web-based mapping element is key to the success of this approach. Its conceptual design is geared to providing access to, and integrating information sources in their existing formats. A site map will serve as a gateway to the elements of other major systems. Controlled areas and physical LU/ICs will be shown on the map and linked to fact sheets and information on the points-of-contact. Attachment A contains an extended outline of a scope of work for the web-based mapping element.

4.3 Information Needs and the Potential of Web-based Applications

Highlights

- Paper records make up the majority of information needs.
- A continuum of information-transfer processes exists at Brookhaven, from computerized data (e.g., environmental data), to scanned documents, to paper records.
- Access options should be based upon current format, the investment needed to put information on the Web, and its intrinsic value to external stakeholders and users.
- There is a potential ROI for improved web-based information for groundwater management, compliance reporting, land use controls, and risk communication.
- Transferring radiological control records and engineering and operations information from paper to a web-based system will be costly and will not provide a real ROI.
- Focus should be placed on reducing quantity of information requiring management.

The CERCLA driven cleanup process, the DOE Order, The Laboratory's environmental stewardship policy and best management practices require that large quantities of information be managed during LTS. Information management is estimated to account for 10 percent of projected Brookhaven LTS costs in FY06-FY10. Sound information management may be one of the most effective means to articulate the government's commitment to the public about LTS. Two pivotal factors in this expression are the Site's ability to manage information and to effectively utilize it to be proactive under changing conditions.

Rapid advances in information technology present an opportunity to lower the LTS mortgage. Since 1998, Brookhaven has been actively developing and piloting several management systems to cope with growing quantities of data on cleanup, and a sophisticated relationship with its stakeholders. These initiatives include the establishment of EIMS, and, more recently, participation in LandTrek, a web-based information repository on site-closure practices within the DOE, DOD, and other Federal agencies (http://www.bnl.gov/esd/landtrek.htm).

The Laboratory took the lead in expanding the geographic information system (GIS) component of LandTrek, a data-communication project that is being funded and explored at several DOE sites. Hazmed, an environmental and communications company in the Washington, D.C. area, is conducting the technical portion of this project. The goal of our pilot project was to establish better communication with stakeholders on environmental issues that are important to them, as well as to increase the staff's ability to review and evaluate site environmental data easily and quickly. This includes investigating how to place environmental monitoring data of interest to the community and staff on the Internet or through other forms of public communication.

The purpose of this section is to set out a preliminary assessment of information needs, media- and access-preferences, and assess the value of GIS driven web-based applications for LTS.

4.3.1 Assessment Process

4.3.1.1 Definition of user groups and needs

The first step of the assessment process was to define user groups, their needs, and preferences on media and access. The second step was to demonstrate web-based applications currently under development at Brookhaven.

Nine representatives of Brookhaven's site operations staff with an interest in LTS information needs gathered for a series of work group discussions between December 2001 and February 2002 (Table 1).

Table 1. LTS Information Management Working Group

Name	Affiliation	Interest
Drew Bennett	Environmental Services	Groundwater management; compliance; records
Bill Chaloupka	Plant Engineering	Engineering & operations
Mary Daum	Environmental Services	Information Management
John DiNicola	Plant Engineering	Engineering & operations; land use
Andrea Epple	Radiological Control	Radiological control; records
Kathy Geiger	CEGPA	Risk communication
Jerry Granzen	DOE /BAO	Environmental remediation, compliance
Bob Howe	Environmental Management	Groundwater remediation; records; 5 yr review
John Selva	Environmental Services	Compliance

The work group identified what information they own, who the users are, and gave a simple forecast of future information needs. They were asked to comment on the existing media and means of access used, and what they would prefer. The team focused on several elements relative to LTS information:

- Identification of information users and the type of information they require,
- Drivers for information management,
- Classification of information into modules, identifying the owner, user, and medium,
- Processes/media by which information is accessed, and
- Future requirements for access to this information, either electronic or paper-based, and the types of repositories that best will serve the user groups during LTS.

Input from the LandTrek Stakeholder Outreach Project (Engel-Cox, 2000) also was assimilated into this assessment. The Stakeholder Outreach Project's purpose was to identify the users of Brookhaven's environmental information, what information they need or would like to have access to, and how they would prefer to see that information. Meetings and workshops were held with internal (BNL) and external (community and regulator) stakeholders. Table 2 details the stakeholder groups that gave suggestions for this project and the reason for their participation.
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Table 2. LandTrek Stakeholder Outreach Project: Participants

Environmental Services and Environmental Management staff	• Monitor The Laboratory for compliance • Characterize and cleanup contamination
Brookhaven facility users	• Monitor and understand their facility's environmental performance.
General staff (an invited focus group and an open presentation)	• Vested interest as employees
Brookhaven's Public Affairs media/communications representative	• Media presentations • Reporting to employees
Focus group of external stakeholders*	• Regulators • Potentially impacted by our activities

* Included USEPA Region 2, NYSDEC Region 1, Suffolk County Dept. of Health, Central Pine Barrens Commission, Trout Unlimited, Civics and other neighbors.

Based on the input and the dialogue during these meetings, the user groups were classified, the specific types of information they use, what media the information is in, and how they access it; this is summarized in **Table 3**. The information being used then was classified into "information modules" to ease their management and to help assess the comprehensiveness of the information. This is summarized in **Attachment B**.

Table 3. Information Needs Assessment

Information User Group	General Information Needs	Existing Media/Access	Preferred Media/Access
Landlord-(compliance, site master planning)	Regularly receives monitoring data to ensure compliance with permits, CERCLA and ROD cleanup goals. Accurate information on the location and nature of residual hazards. The cleanup processes and the operational and engineered controls deployed. Land use and institutional controls. Operational information to ensure efficient operations. Notification on change in conditions or design assumptions.	Electronic: EMIS FUA Soil contamination maps Maps of plumes and public water service areas Landtrek pilot Paper: Five-Year Reviews Annual Groundwater Monitoring reports DMRs Site master plan Inspection reports As-built drawings RODs O&M manuals	Website Facility managers interested in maintaining their facilities in compliance were reluctant to rely on Internet access and preferred paper reports.
Employees	Same as general public; Historical records on work place	Electronic: BNL Website, ERD Website, Landtrek pilot Paper: Clean Update BNL Bulletin	· Key subjects of interest are onsite drinking water and air emissions · Secondary subjects: groundwater, surface water, vegetation, fauna · Additional information wanted: contextual information, real-time weather · Important issue: Want data to be public but want people to understand the context of the data and to see that the lab is making progress · Access: Internet access is preferred.
General Public	Information on BNL activities; including general events and cleanup actions. The programs, processes, and operations performed onsite; impacts these operations have on human health and the environment; information that ensures that the site remains protective Need to develop a communication plan	Electronic: BNL Website, ERD Website, Landtrek pilot Paper: Clean Update	CERCLA Reading Room? · Key subjects of interest are groundwater and how it relates to drinking water, surface (river) water, and fauna · Secondary subjects are air emissions · Additional information wanted: sources and and destination of contamination, standards and units in understandable terms · Important issue: Make the information interesting and interactive for diverse audiences · Access: Internet with email listserv for breaking news.
Regulators	Regularly receives monitoring data to ensure compliance with permits, CERCLA and ROD cleanup goals. Accurate information on the location and nature of residual hazards. The cleanup processes and the operational and engineered controls	Paper: Five-Year Reviews Annual Groundwater Monitoring reports	to be determined

An information transfer process map (**Figure 6**) illustrates the existing processes;

- multiple data owners, users, and connectivity of information;
- the evolution of various media and information management platforms;
- some duplication of responsibilities and effort.

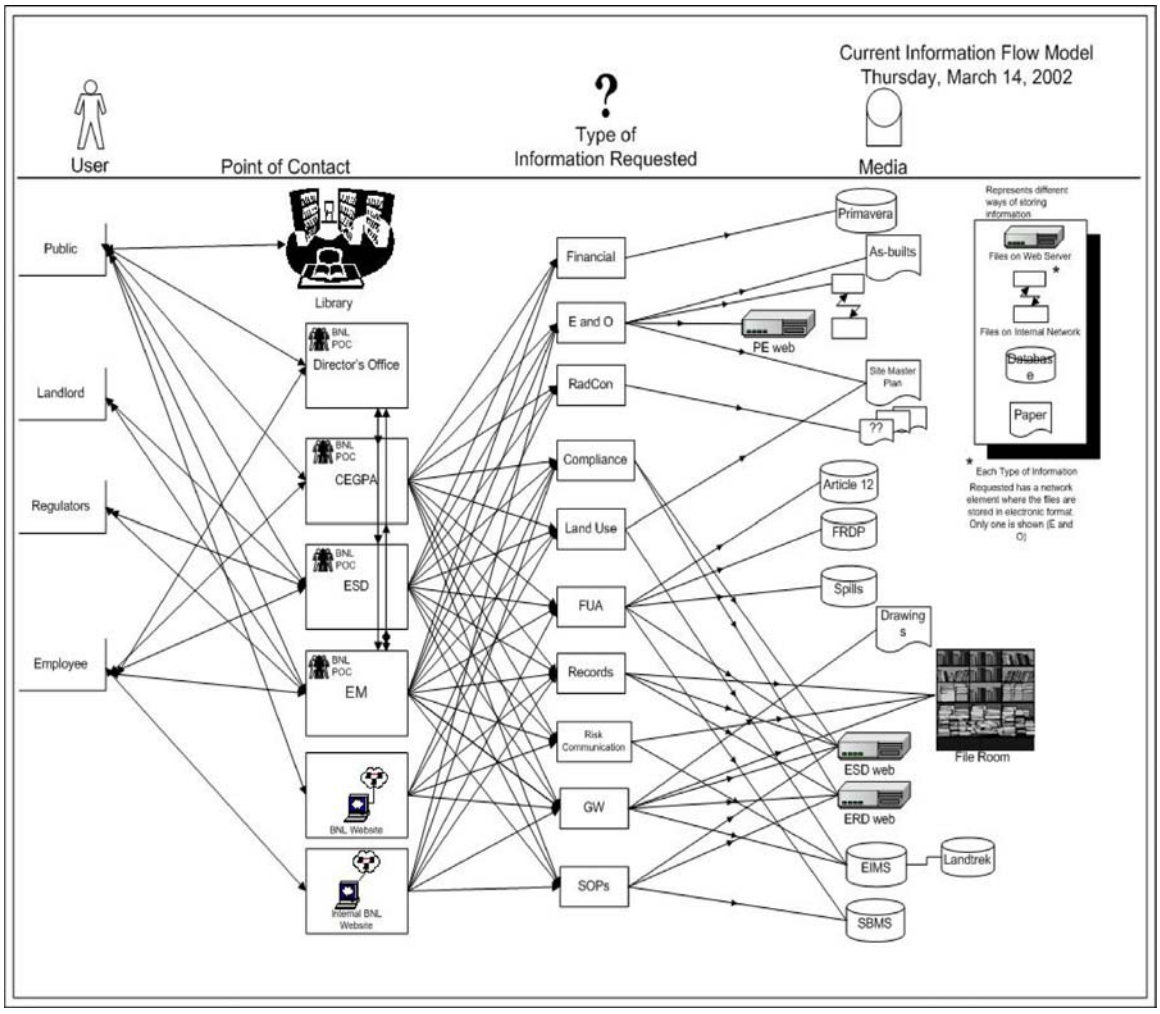

Figure 6. Existing information transfer processes

4.3.1.2 Demonstration of web-based applications under development

While all user groups are familiar with traditional routes of accessing information (paper reports, telephone calls), some may be less comfortable or experienced with more "high-tech" options, such as Web-based access. To introduce them to this approach, Web applications in use or under development at Brookhaven were demonstrated to working groups and stakeholders. Three applications are illustrated in this section.

A hard copy of the soil contamination map is widely used for planning work and land use control. This map is demonstrated as a web-based application (**Figure 7**), which gives information on the type of contamination, cleanup status, and points of contact, with photographs and links to associated documents.

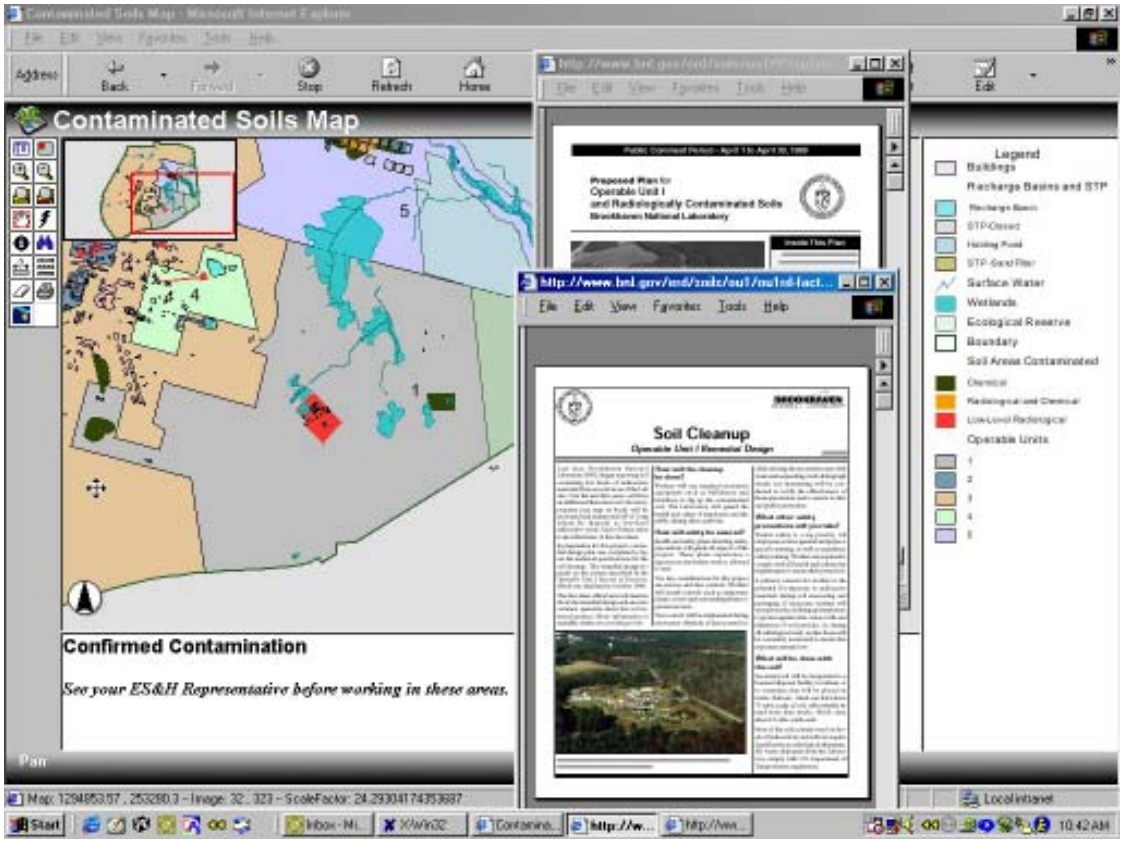

Figure 7. Web Application: Soil Contamination Map

Another application under development is a "clickable" map of buildings and roads. The example shown in **Figure 8** is a site-based map that zooms in on the Brookhaven Graphite Research Reactor (BGRR), which is undergoing D&D. By clicking on the building in the base map, the user is linked to facility key plans and photographs. It was suggested that this application should be expanded to include additional facility information, such as waste-management areas, and should have links to Facility Use Agreements and The Laboratory's Chemical Management System. This application was well received by internal technical users and managers, and is valuable for land use control planning and for external stakeholder outreach.

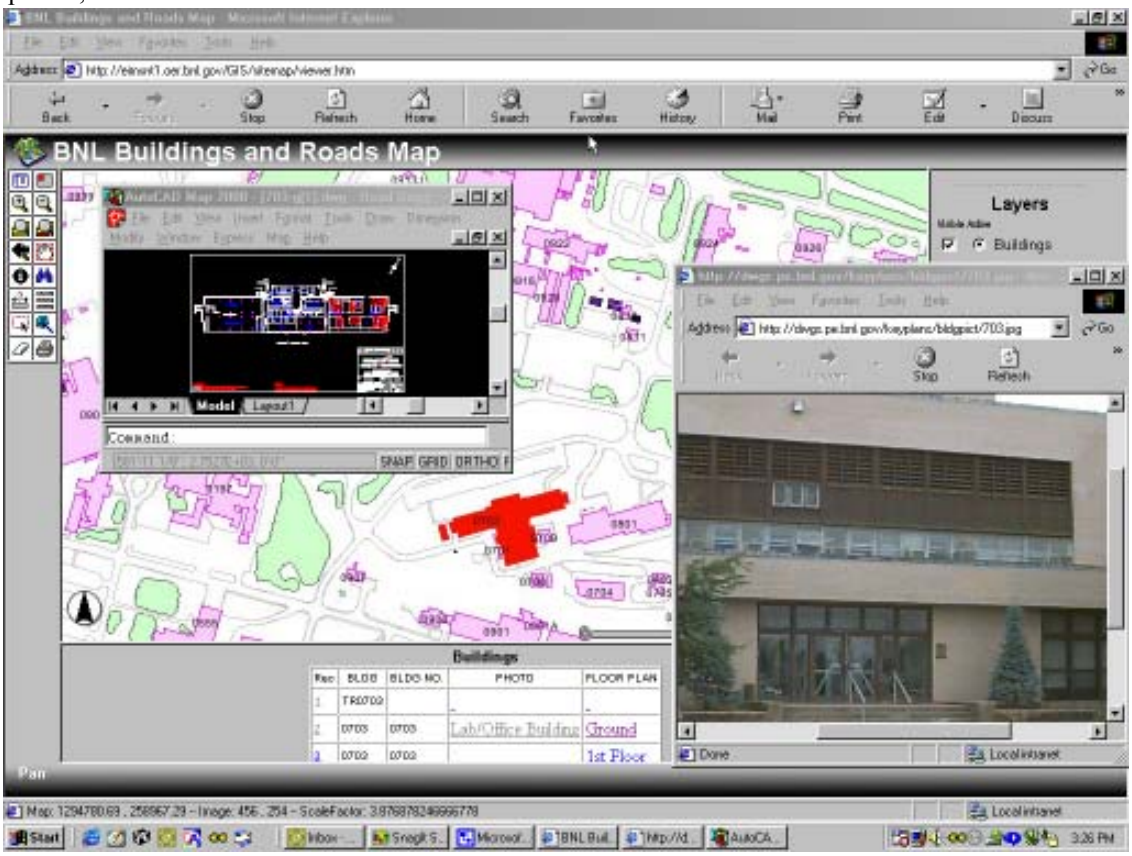

Figure 8. Web Application: Brookhaven's Buildings and Roads Map

The initial LandTrek pilot application, shown in **Figure 9**, presented groundwater monitoring data to external stakeholders as a risk communication tool. The concept was well received at first. However, by the time the pilot was completed, its reception was mixed. There were several reasons for this. One was technical design. The information in the site was considered too detailed for the layperson, but not comprehensive enough for technical users. Another reason was that priorities had changed. The champion of the project left The Laboratory, as did the Laboratory Director, also a strong proponent. Furthermore, The Laboratory's efforts to improve relations with the general public were increasingly effective. Consequently, there was less support from Brookhaven and less demand from the pubic for the kind of data that the LandTrek pilot delivered.

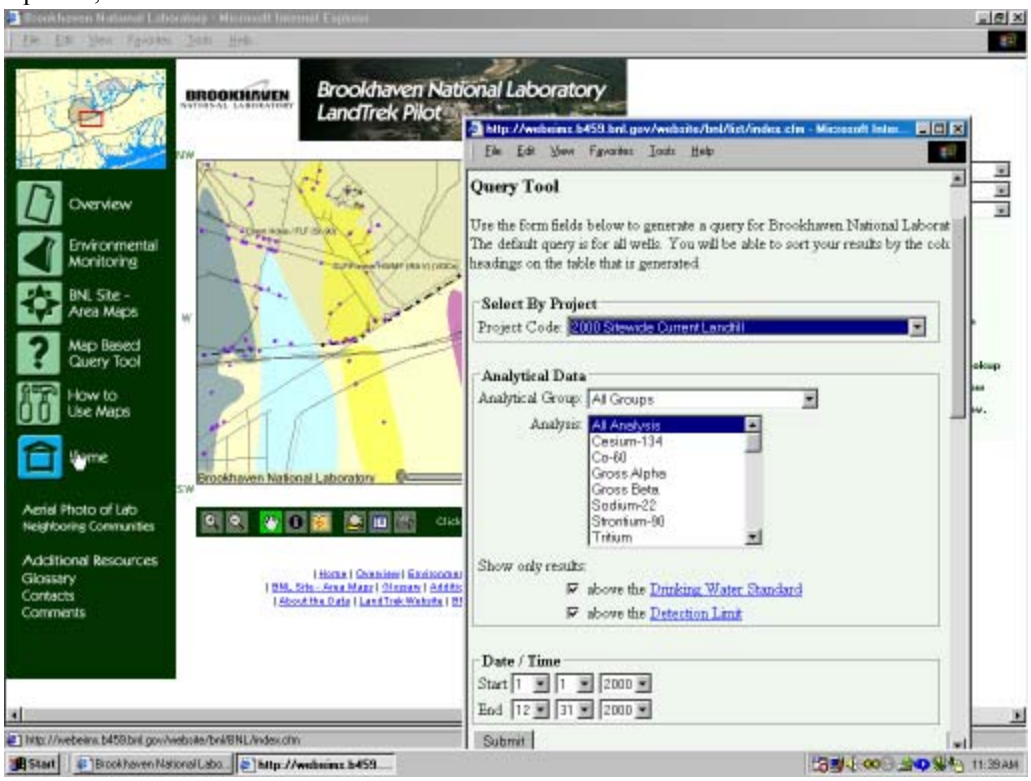

Figure 9. LandTrek Demonstration: Groundwater Quality Data

4.3.2 Results of the Assessment

4.3.2.1 Observations and comments

Members of the working group and LandTrek participants made several observations and comments that illustrate the range of opinions on information management at Brookhaven. They provide useful input for future planning.

Facility Operations Perspective– The Laboratory currently collects more operational data than it uses. A highly computerized information system for data on facility operations is not necessary (e.g., O&M manuals, raw operating data, as-built drawings). The groundwater treatment plants were designed without supervisory control and data acquisition (SCADA) principles, and probably it would be cost-prohibitive to retrofit these systems. The Laboratory should focus on reducing the amount of information being managed.

Radiological Controls Perspective – Our current system is paper-based. Representatives have their own file on each facility. Hence, the files are not centralized. Many records are archived, making them difficult to recover. Staffing changes compound the problem. Databases maintained by other divisions do not meet our needs. A new system that would let us easily find more detailed information would be invaluable. A central archive also would be useful.

Groundwater Management Perspective – The groundwater cleanup program has generated more data and information than any other element of The Laboratory's cleanup program. The rate of data generation is forecasted to remain at very significant levels for the next 10-12 years (see Figure 5). An electronic means to manage this quantity of information is vital.

The development of an electronic database and some web-based tools enabled the processing of the growing amounts of data generated without significantly increasing staffing levels (Full Time Equivalents, FTEs). However, some data processing tasks would be better automated. For example, the groundwater remediation exit strategies rely on presenting system performance indexes (e.*g.*, comparing the actual rate of cleanup of the aquifer to model predictions, the rate of improvement in groundwater quality based on water-quality data, and the mass of VOCs extracted). This process requires too much manual work, and there is insufficient integration across the multiple platforms being used. There could be real cost-savings in standardizing and automating these tasks. However, converting some documents (e.g., engineering- and construction- drawings) for the sake of standardization probably would not add any additional value.

Compliance Perspective – Establishing an integrated database has resulted in more timely review of data, and less effort in summarizing them for reporting. However, to achieve measurable cost-savings, the focus should be on reducing reporting requirements, rather than just improving access to information.

EIMS Perspective – Electronic information management can offer added value, especially when long term access may be required. It facilitates the combination of information from different sources. Web-based applications can be accessed by, and customized for, many different user groups while providing one readily identifiable source for environmental data. Nevertheless, this is not always the best answer – the information may have only a short useful lifetime, or only a small user community. Electronic information management and access is most valuable when the information is already computerized (e.*g.*, reports typed on a PC), when the user community is large and/or scattered, when the information must be integrated with information from other sources, or when changes in information need to be tracked.

Stakeholder Outreach Perspective – Information should be timely, spatially based, and placed in context with regulatory guidelines and regulations and organizational goals. The stakeholders preferred an interactive web site. The basic information (the "big picture") should be presented first, with supporting detail available.

4.3.2.2 Conclusions

We drew the following conclusions about the user's information needs and the information transfer processes from on our discussions with the working groups and stakeholders:

- The current information transfer processes at Brookhaven range from highly efficient (e.g., environmental monitoring data) to very poor (e.g., historical records).
- The need to access information documented in Brookhaven's Administrative Record will continue in the future.
- A variety of user groups require access to maps, aerial photos, and other GIS-based information.
- The information on changes in conditions or environmental events that occur at The Laboratory or at off-site facilities must be communicated promptly.
- Public interest groups require information about the impacts of contaminants and releases on human health and the environment.
- Public and employees prefer access to this data through the Internet; regulators still prefer to see this on paper copy (compliance).

4.3.3 Options for Managing Information

4.3.3.1 Service models

The information needed for LTS is distributed across the site, managed by multiple administrative divisions, and access to it varies. This situation offers three models for its long term management and transfer.

1. Decentralized. In this model, owners of the information (originators) manage it independently, generally in the way that best meets their needs. The requirements of external users may or may not be considered in deciding on its management. External users initially access the information through a point-of-contact (POC) at the place where the information resides (in many cases, potential users may be unaware of the existence of the information). Users who require different kinds of information from several sources have the responsibility for retrieving it, combining it, and interpreting the findings.

   Advantages
   - Low cost (no change to current information management practices)
   - Permits a diverse mix of information sources

   Disadvantages
   - Limited/difficult access
   - Hidden costs – users' time and effort to locate, obtain, and use the information
   - High risk of "lost" information and consequently, the need to repeat the work
     - Users are unaware that the information exists or cannot locate it
     - Owners may destroy or archive information, unaware that it is needed, especially under changing circumstances
     - Lack of overall information management
   - Difficult to integrate information from multiple sources (e.g., spreadsheets, paper maps, printed reports specifically formatted)
   - Public perception that Brookhaven is unwilling to share information

2. Centralized. In the Centralized model, all information is accumulated and managed at one location, which also is the single point for access. Originators submit their information to an administrator who compiles it into a single repository. The medium is standardized and available through a Web site. The administrator becomes the information "owner" and manager and the sole POC for both originators and users.

   Advantages
   - Ease of access – only one place to access and wide availability
   - Ease of use – information is standardized
   - Highly structured management system controls all information
   - Clearly identified responsibilities

   Disadvantages
   - High cost of standardizing the information, and maintaining the system
   - Originators lose ownership of their data
   - Risk that originators may be unwilling to release their information

- Does not work well in a diverse information environment

3. Optimized Hybrid. This model combines the advantages of the other two models. Ownership remains decentralized, with the originators retaining their information, but standardizing common or key elements identified by a site information manager. Access to electronic information is centralized with a portal (Web site) that interfaces with all the system's distributed elements. The Administrative Record and a Site POC serve as the centralized access points for paper based, and person-to-person information, respectively. This option is focused on key information.

   Advantages
   - Lower cost than the Centralized model
   - Permits diverse mix of information sources
   - Ease of access – only one point of access, and, wide availability (electronic)
   - Ease of use – key elements allow users to standardize and integrate different types of information
   - Structured management has oversight
   - Internal flexibility that can be implemented gradually

   Disadvantages
   - Higher cost than the Decentralized model
   - Risk that changes made by one owner could affect the data of other owners and the access system

The process map in **Figure 10** shows the ideal state of an LTS "Optimized Hybrid" information management system. It illustrates a rapid and orderly access to up-to-date information that is our goal. Achieving it requires a significant investment in time and money. Theoretically, it would enable Brookhaven to work smarter, but would not necessarily entail measurable savings to site operations. Comparing this map to the existing conditions in **Figure 6** reveals the intrinsic benefits to the information users of such a semi-centralized system: tangible benefits in the form of costs savings are difficult to depict.

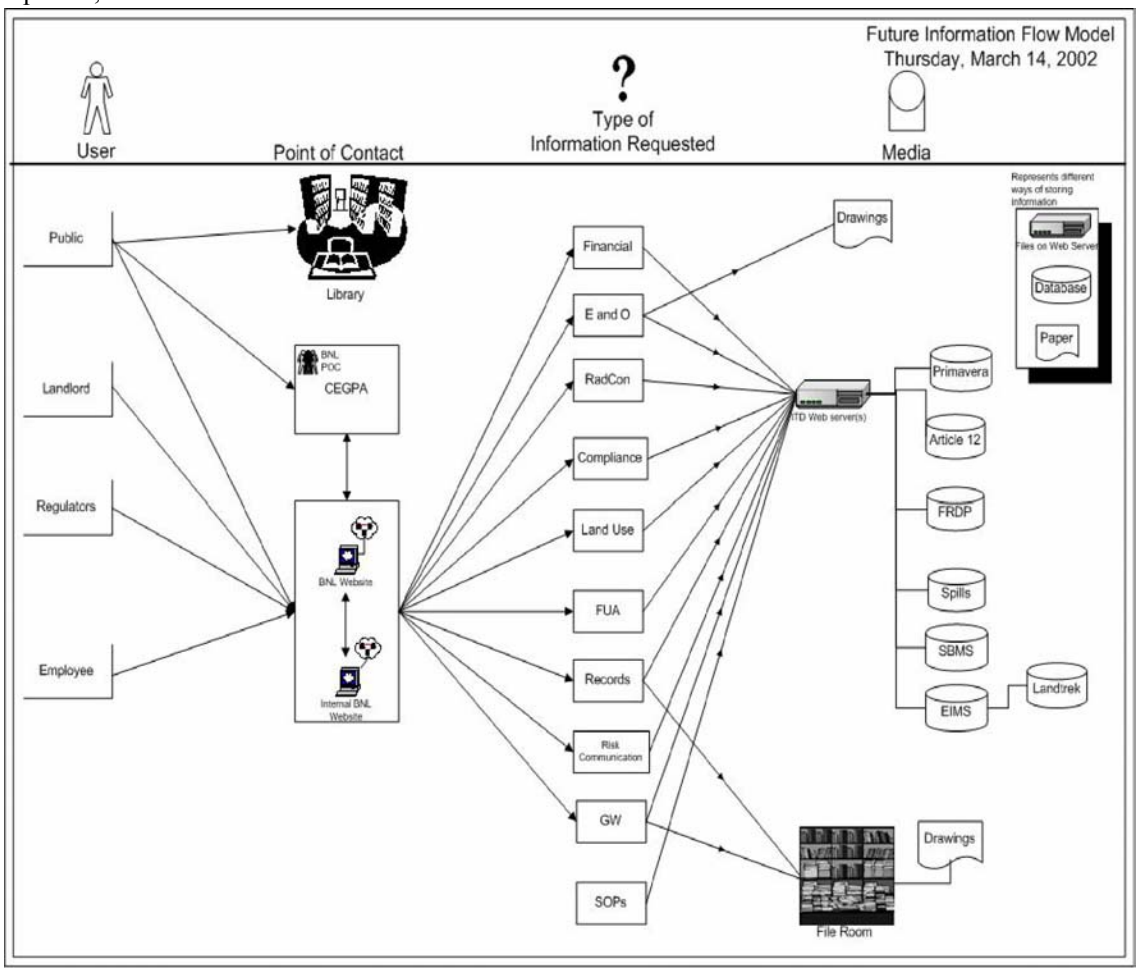

Figure 10. Hypothesized Ideal State of Managing LTS Information

4.3.3.2 Selecting an option

The assessment highlighted several parameters that will affect the choice of an information management option for our LTS.

- There is no CERCLA/IAG driver or DOE Order for a fully integrated website (this must be evaluated from the perspective of a best management practice (BMP)).
- Web access per se does not reduce requirements for reporting or record keeping.
- Web access facilitates work by giving broader access to more up-to-date and pertinent information.
- With Web access, fewer information management staff can support more users.
- Only about 30 percent of The Laboratory's data already is in electronic format.
- There is no need to electronically access some information, such as RCRA inspection and DMR forms; this probably will hold for the foreseeable future.

- The development of, or conversion to, computerized access requires a large initial investment; this outlay can be leveraged over the long term. Although Brookhaven's EIMS took $10M and 6 years to develop, the availability and usability of environmental monitoring data has improved. The number of FTEs supporting the system has not declined, but the scope of work has increased (2400 samples in 1997; 7400 samples in 1999; 21,000 samples in 2001), with a significant net reduction per sample in the costs of managing information.
- The Laboratory invested $250K in the LandTrek pilot. Other Web sites being constructed to manage internal technical information could be a foundation on which to gain access to existing electronic data at rather little additional cost.
- Changing to a completely Web-based system would require more investment that is not included in the EM baseline, and such a change has a low ROI potential (it does not reduce the amount of information being managed).
- There is some advantage to automating certain tasks.
- The Laboratory's immediate focus should be on reducing reporting requirements and data collected. Resources are better spent on using the information, rather than tabulating it. Our emphasis should be on tasks that can be automated, or are already in electronic media.

4.3.3.3 Value of a graded approach

The goal of LTS information management is to collect, maintain, and make available cost-effectively information on Long-term Stewardship. Developing a Web-based system potentially imposes a significant investment, with unresolved benefits. If the system was implemented through a phased approach, the potential value of each step could be assessed. Also, a graded approach offers flexibility in the face of fluctuating funding levels.

Each need for LTS information identified in Tables 3 and 4 can be prioritized and its establishment managed as a project. A scope of work can be defined and a project cost and schedule developed. Priorities can be assigned according to projected cost *versus* available funding and need for Web access to the information. An evaluation after establishing each step can measure success according to defined criteria, identify lessons learned, and suggest additional steps to subsequently improve the completed work.

4.3.4 Path Forward

The conclusions drawn from the working group's assessment of needs, and from matching the Site's status and requirements to the information management options suggest that the current system can support LTS. However, better Web-based systems could be useful in some cases and may offer real efficiencies. The LandTrek project should be refocused to meet these basic needs and demonstrate real performance and cost improvements.

The team concluded that Web-based applications could be valuable to managing information in discrete areas. They recommend developing a formal information management plan stating Brookhaven's objectives, how success will be measured, and setting out scopes and schedules of the work needed to achieve the goals. An LTS information management plan must pose the following questions about each different source of information that it will govern:

1. How was the information originally captured or acquired, and in what format?
2. How frequently is the information updated?

3. Who will be the users?
4. How many users are anticipated?
5. Where are the users? Are they near the source of the information, or scattered in many locations?
6. How frequently will they need to access the information?
7. How will the information be used?
8. For how long will the information be actively needed?
9. Will old information be destroyed or archived?
10. How difficult will it be to retrieve the information after it is archived?

Because of the quantity of information already being managed, implementing web-based applications in key areas now can capture this value. The diversity of user needs and preferences and the non-electronic state of much of the information indicates that this work should be prioritized and evaluated periodically. These applications will be added to the Laboratory's Environment web page (http://www.bnl.gov/bnlweb/envindex.html).

4.3.4.1 Development of near-term applications

The team conceptualized the following applications as initiatives for the near-term improvement of the process, and potential money savers.

Conceptual design and functionality (general)

The LTS web-mapping application will open with a map of the Brookhaven site and surrounding area, including roads, rivers, and other contextual information in the main screen area ("frame"). An active reference map in one corner of the screen will show the location of the mapped area in a regional context. This map will change as the user zooms in and out. The availability of some information, such as local roads and road names, will depend upon the scale of the map.

LTS information that is based on location will be stored in map layers that can be turned on or off as the user wishes. An "active" layer can be selected (the layer for which the user wants more information), and then clicking on a map element can access the information. This information may include data stored within the map layer, links to distributed databases, links to scanned documents, and listings of other (non-digitized) related documents and their locations. Links will be given to metadata that explain the source, currency, and reliability of the information.

The user will be able to download and print the retrieved information. The screen map can be inserted into a preformatted page with legend and scale bar, and then saved to the user's PC as a graphics file for inclusion in a report or presentation. Data retrieved from a database also can be saved in a format readable by standard spreadsheet or word processing software, thus allowing the user to combine data from different sources.

General LTS information, a web-site users' guide, glossary, and other LTS information that cannot be tied directly to a specific location can be accessed by clicking on a link in another frame outside the map area.

Location and Status of Waste Areas The four categories of waste sites that will be transferred from EM to the landlord should be presented on a Waste Area Location map with links to a fact sheet on each class of waste site, and a point-of-contact for additional project specific information. The following are the classes of waste sites:

- Remedy-in-place-Operations, Maintenance, and Monitoring

These sites include landfill maintenance and monitoring, groundwater treatment system O&M and monitoring, and maintenance and monitoring of the Peconic River.

- Remediation Complete-Free Release/Unrestricted Use

The scope of LTS work for these sites is envisioned as including archiving and maintenance of records of closure, and agency documentation agreeing to completeness. An example is the Landscape Soils Remediation project where soils were restored to a residential-land-use risk scenario.

- Active Remediation Complete-No Further Action

These projects meet cleanup criteria defined for the project, but do not support free release or unrestricted use. For example, the former Hazardous Waste Management Facility will be restored to an industrial-land-use risk scenario and will likely require institutional controls, surveillance, and monitoring.

- Radiological Facilities with D&D Complete for Restricted Use

These projects meet cleanup criteria defined for the project, but do not support free release or unrestricted use. For example, the Brookhaven Graphite Research Reactor will be decontaminated to an industrial-land-use risk scenario and will require institutional controls, surveillance, and monitoring.

Even before transfer, details of the status of each waste site could be added to the web site. For example, site maps could indicate the backlog of soil remediation sites, groundwater treatment systems to be constructed, and the backlog of radiological facilities awaiting D&D.

The landlord, employees, regulators, and the public would use this information. It would function as a "scoreboard" on the progress of remediation, and would supply information on post-remediation risks and what controls were in place to manage their post-cleanup state. The site would have links to several existing web sites and would provide downloadable maps for reporting purposes. In addition, there would be links to key decision documents (e.g., Records of Decision).

Land Use and Institutional Control As a condition to the OU V Record of Decision, The Laboratory is required to have a Land Use Controls Management Plan. The objectives of, and strategy to develop this plan is discussed in Section 4.2 of this report.

A web map will be elaborated to illustrate and inventory all LU/ICs being implemented and maintained by the Laboratory. This application will build upon the Waste Area Location map described above. The layers that initially will be included will be those that currently exist in GIS format or that can be easily converted. The number of layers and documents will depend upon available resources, but potential layers and examples of associated information include the following:

- Current Land Use (1995 Plan, Brookhaven)
- Future Land Use (2014, Brookhaven)-Post closure scenario
- Site Master Plan (2000, Brookhaven)
- DOE owned property with security
- Off-site zoning data-as available
- Off-site easements and leased property for groundwater systems-as available

- Land Use Restrictions based on Cleanup Goals (document/fact sheet links)
    - Industrial
    - Residential
    - Restricted Waste Containment Areas (i.e. landfills)
    - Private well restriction
    - No fishing restrictions
    - No hunting restrictions/warnings
    - Fences around 650 sump, former HWMF

Other land use constraints will be integrated over time. They include

- Regulated wetlands
- Upton Preserve
- State Wild & Scenic River Corridor
- Source water protection areas
- Activated soil shielding

Linkages to the following documents or websites likely will be developed.

- Future Land Use Plan, Site Master Plan, Institutional Plan, Land Use Controls Plan
- Facility Use Agreement for general undeveloped areas
- Suffolk County Department of Health's website for private well permitting
- Land Use Controls Fact Sheet, including points-of-contact for additional information
- Current off-site land use and zoning within two miles of the Brookhaven property

The primary value associated with the task will be a reduction in risk and improved stakeholder communication. Loss of records and loss of access to information were identified as potential failure mechanisms with both high probability and high risk. Incorporating distributed LU/IC information into the centralized web-site aims at reducing this risk. Some long term cost savings may accrue as redundancies in data are identified and eliminated. Resources required to compile information also will be reduced (most Brookhaven data required for the 2000 LTS NDAA Data Call were electronic, but were accessible only by trained personnel).

Historical Radiological Releases and Spills External stakeholders and employees are concerned about controlling radiological releases and avoiding exposure to historical releases. The Nuclear Regulatory Commission also had requirements to track such information. The Radiological Control Division currently undertakes this function. This information should be shown on a map with links to a fact sheet for each class of release and a point-of-contact for additional information. Initially, the release sites will be represented as points, since specific information adequate for defining areas is not available. The points will be labeled, and clicking on one will open any spill reports for that location.

4.3.4.2 Other potential applications

Based on the Team's input, two other potential applications were identified for future development. While these applications appear to be needed, their development will require significant resources. Therefore, their cost-benefit should be considered carefully during the formulation of the Information Management Plan. They are as follows:

Groundwater Cleanup Index Tool The performance of the groundwater cleanup efforts is measured against the cleanup goals agreed to in the OU III Record of Decision. To aid in making this judgment, The Laboratory generated a number of performance indexes that are applied to each groundwater treatment project. They include the rate of mass removal of VOCs from the

aquifer compared to predictions, the mean target VOC concentration in "core" monitoring wells, the trend of the mean, and a Kendall-Mann statistical test to assist in determining when asymptotic concentrations are reached in the aquifer. In addition, the map of the plume is compared to the contaminant's distribution predicted by the model for the appropriate stage of remediation.

Developing these indexes for 17 groundwater treatment projects is labor intensive; data must be downloaded from several databases and manipulated on spreadsheets. The groundwater data queries were automated, but not the calculations and statistical tests. In addition, the data on groundwater pumping rate data are not in the EIMS, but are on spreadsheets, making mass-removal calculations cumbersome. Integrating the databases and automating these tasks potentially could result in real cost savings.

"Clickable" Facility Information There is only limited building information in existing web applications. Laboratory management and the Radiological Controls Division expressed a need for simplified, rapid access to the information provided in this application. There is a desire to apply this to all Brookhaven's facilities, but this is impractical in the near future. Therefore, it probably would be accomplished in stages, based on the types or classes of facilities (i.e., high risk or complex facilities). The functionality of the existing applications can be combined and enhanced. The buildings will appear in the initial view; the building's numbers appear as the user zooms in on the map. Clicking on a building will do the following:

- List the contents of Plant Engineering's buildings and structures database for that building (e.g., area, ground elevation, name/description, street address, building manager).
- Show an image of the building, if available.
- Provide links to
    - Facility Use Agreements for that building
    - PE key plans. Clicking on one of these links will bring up a CAD drawing of the selected floor plan (a link to download the necessary viewing software will be available). These drawings contain multiple layers that also can be turned on and off by the user
    - Facility Review and Disposition Project (FRDP) database content for the building
    - Applicable spill reports
    - DOE Facility Information Management System (FIMS)
- Give access to information about any other documents describing historical use of the building.
- After selecting a key plan, allow the user to click on a room to bring up:
    - The occupant's name and other information about the occupant
    - A link to the Chemical Management System (CMS) records for that room

Integrating such diverse information sources will benefit the overall management of The Laboratory's infrastructure. Linking various facility databases and reducing redundancies among them will save money by improving asset tracking and disposition, and will facilitate better-informed decision-making. Customized reports will reduce the cost and improve the timeliness of reporting to DOE. Furthermore, employee safety will be enhanced because emergency responders will be able to print rapid custom maps using the most up-to-date key plans, building usage information, and CMS data.

Attachment A

Draft
Scope of Work
Mapping Land Use Controls Management
4/9/02

Task 1.Link from the Brookhaven web page under "Environment".
Call it Land Use Controls Mgmt or Long-Term Stewardship (ITD)

Task 2. Welcome page to Land Use Controls Management.

- Paragraph of text on background and purpose (Brookhaven) Password protected…access on a need-to-know basis (i.e., existing Landtrek-. Criteria & implementation)
- General map of Brookhaven site (interactive), and its location relative to Long Island (Contractor)
- AOCs; Operable Units
- Link to the Land Use Controls Management Plan (Contractor)

Task 3. Interactive Map Development- Waste-site Class Location and Status

1.Remedy in Place – OM&M required
Groundwater Plumes (Brookhaven
Groundwater Treatment Plants (i.e., wells, plant, piping recharge basin)
Operating
Planned
Closed
Capped Landfills
2.Remediation Complete-Free Release/Unrestricted Use
3. Active Remediation Complete-No further Action-Restricted Use
None to date
4. Radiological facilities with D&D Complete for Restricted Use
None to date
5. Soil-remediation Projects Pending
Planned for Free Release/Unrestricted Use
Planned for Restricted Use (Industrial)
Former HWMF
STP
6. Radiological facilities with incomplete D&D
BGRR
HFBR
BMRR
7. Peconic River

The Laboratory will supply all the electronic information. The contractor shall develop the format and functionality.

Task 4. Interactive Map Development- Land Use & Institutional Controls

Current Land Use (1995 Plan, Brookhaven)

Future Land Use (2014, Brookhaven)-Post closure scenario
Site Master Plan (2000, Brookhaven)
DOE-owned property with security
Off-site zoning data-as available
Off-site easements and leased property for groundwater systems-as available
Land Use Restrictions based on Cleanup Goals (document/fact sheet links)

- Industrial
- Residential
- Restricted Waste Containment Areas (i.e. landfills)
- Private well restriction
- No fishing restrictions
- No hunting restrictions/warnings
- Fences around 650 sump, former HWMF

The products of Task 3 and Task 4 product shall be interactive.

Linkages to the following documents or web sites will likely be developed.

- Future Land Use Plan, Site Master Plan, Institutional Plan, Land Use Controls Plan
- Facility Use Agreement for general undeveloped areas
- Suffolk County Department of Health's website for private well permitting
- Land Use Controls Fact Sheet, including points-of-contact for additional information
- Current off-site land use and zoning within two miles of The Laboratory's property

Brookhaven will provide all the electronic information. The contractor shall develop the format and functionality.

Task 5. Interactive Map Development- Ecological Constraints (optional)

- NYS-regulated freshwater wetlands
- Upton Preserve
- State Wild & Scenic River Corridor-as available
- Tiger Salamander (password protected)
- Brookhaven's Potable-well Source Water Protection Areas
- Pine Barrens Management Areas
- Natural Resource Management (????)
- Activated soil-shielding

All map layers will show roads, buildings, and bodies of surface water .

The Laboratory will provide all the electronic information. The contractor shall develop the format and functionality.

Attachment B

Brookhaven's LTS Information Management Modules
March 22, 2002

Module	Type of Data	Current Owner	User	Driver
Engineering & Operations	Engineering • Final design drawings As-builts • O&M manuals Operations • TFMA • Pumping data • Carbon usage • Power usage • Quarterly operations reports • Property management • Capital equipment	EM/PE	Risk communications Landlord	Best management practice
Groundwater Management	Monitoring (Annual Report) • Influent data • Pumping data • Pounds removed • Monitoring-well data • Model estimates • Water levels • Flow patterns • Assessment of cleanup progress	EM/ESD/PE	Risk communication Facility managers Regulators Landlord	Required by IAG Best management practice
Environmental Compliance	• Discharge monitoring reports • Air Emission Statement • Water Pumping data • Article 12 (tanks) • Class V UICs • Waste generation metrics • RCRA storage inspections • Shutdown petition • Decommission petition	ESD/EM	Regulators Risk communication	Required by permits and permit equivalencies
Facility Use Agreements	Facility Review Reports Historical Site Review FRDP database Historical rad footprints Experimental process reviews Spills database Article 12 DB Process assessments Historical drawings CMS	Facilities & Operations	Employees Landlord	Internal procedure requirement Best management practice
LU/ICs	Current land use (BNL site) Future Land Use Plan Site Master Plan Institutional Plan Institutional controls Offsite zoning and land use Easements, access agreements, lease agreements	PE	Risk communications Regulators Local government Employees	Record of Decision requirement

Records and Decision Documents	Administrative Record Spatial inventory Closeout reports Decontamination/cleanup standards Post-cleanup status (what's left) RI/FS reports Risk assessments Action Memos Record of Decisions Closeout reports Delisting 5-Year Review	EM	Risk communication General public Regulators Employees	Mix of required and Best management practice
Radiological Control	Surveillance and monitoring data Historical rad footprints DB of historical information	RadCon	Employees Risk communication	Required
Risk Communication	Five-Year Reviews Public access to summary information Web map access Contingency plan actions/status Fact sheets	CEGPA	General public Employees Local government Regulators	Environmental stewardship policy
Financial Controls	Schedule Work packages • Inter-divisional • EM/SC Budgets	EM	DOE Landlord	Required