BNL-64595
Informal Report

Northeast Waste Management Enterprise (NEWME) 1996 Annual/Final Report*

by

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and

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DISCLAIMER

EXECUTIVE SUMMARY

The Northeast Waste Management Enterprise was created in response to Dr. Clyde Frank's vision of a new partnership between research, industrial, and financial sectors, with the goal of speeding development and use (particularly at U.S. Department of Energy [DOE] facilities) of environmental remediation technologies. It was anticipated that this partnership would also strengthen the international competitiveness of the U.S. environmental industry. Brookhaven National Laboratory's (BNL) response to Dr. Frank was a proposal to create the Northeast Waste Management Alliance, later renamed the Northeast Waste Management Enterprise (NEWME). Recognizing the need to supplement its own technical expertise with acumen in business, financial management, and venture capital development, BNL joined forces with the Long Island Research Institute (LIRI).

Since its inception at the end of FY 1993, NEWME has achieved several significant accomplishments in pursuing its original business and strategic plans. However, its successes have been constrained by a fundamental mismatch between the time scales required for technology commercialization, and the immediate need for available environmental technologies of those involved with ongoing environmental remediations at DOE facilities.

Some of NEWME's accomplishments since its inception include: working with a private corporation to facilitate tests of a BNL uranium extraction process for treating high-clay soils from the RMI site; verifying a BNL process for ash encapsulation in virgin polyethylene; assisting the National Center for Manufacturing Sciences in developing a program to promote and facilitate recycling of durable goods containing plastics; publishing a comprehensive evaluation of pyrolysis technologies; evaluating environmental technologies developed in countries from the former Soviet Union (FSU); and participating in the organization and direction of the NYS Environmental Business Association, a rapidly growing network of environmental technology and remediation companies in New York State.

During FY 1996, NEWME staff developed a technology commercialization screening methodology which was successfully merged into the Global Environmental Technology Enterprise's (GETE) technology selection and review process. NEWME staff also reviewed technologies provided by the subsurface contaminants focus area (SUBCON), finding that most did not require commercialization assistance, *per se*, but rather assistance in introducing the technoloies to EM30, 40, and 60 personnel at various DOE sites for implementation. In addition, NEWME evaluated several environmental technology databases of potential use to DOE environmental site managers. An important task which remained uncompleted was a search for technologies formerly funded by EM50 which were abandoned for non-technical/economic reasons.

During FY 1996, NEWME (and Dr. Frank's entire Enterprise construct) essentially ceased to exist. However, it is important to note that the BNL-LIRI partnership continues, and is available to assist EM50 in the evaluation of advanced environmental technologies and in making those technologies commercially available.

INTRODUCTION

This report summarizes the activities of the Northeast Waste Management Enterprise (NEWME) during FY 1996. Inasmuch as FY 1996 proved to be the last year of funding for the program by DOE/EM50, it is appropriate to include in the report some background information that provides the reader with a perspective for understanding the narrative that follows.

BACKGROUND

In March of 1993, Dr. Clyde Frank, Deputy Assistant Secretary of Environmental Restoration and Waste Management (ERWM), and Head of its Office of Technology Development (OTD) of the U.S. Department of Energy (DOE), visited Brookhaven National Laboratory (BNL) to describe his vision of a new form of partnership called an Enterprise. The need for the Enterprise was grounded in the idea that commercialization of new, more efficient and economical environmental technologies would address the DOE's site remediation requirements while simultaneously securing a strong U.S. position in the environmental technology industry. It was Dr. Frank's view that the Enterprise could bring together the national laboratories, the private sector, and other technical and business expertise wherever it might reside (including foreign countries) for the express purpose of enhancing the ability of the DOE to meet its responsibilities with respect to site remediation. This could be accomplished by creating a means of transferring new technologies to the DOE complex for rapid incorporation and utilization on all relevant remediation sites.

BNL's immediate response to Dr. Frank's presentation was to create the Northeast Waste Management Alliance, later renamed the Northeast Waste Management Enterprise. Recognizing that the commercialization process requires a good deal more than the technical expertise it could provide, BNL joined forces with the Long Island Research Institute (LIRI) in establishing NEWME. Through a subcontract with LIRI (Attachment 1), BNL was able to secure and combine its technical expertise and familiarity with the national laboratory system with the scientific and engineering acumen and extensive business and financial management experience of LIRI's staff, as well as with LIRI's associated venture capital fund (i.e., the Long Island Venture Fund). NEWME's program manager was Peter Ritzcovan, whose vision and tenacity were important in bringing the Enterprise concept to fruition via BNL's program.

An independent, nonprofit organization, LIRI was established in 1992 by Long Island's leading research institutions to make effective use of regional scientific and technical resources for local and national economic development. Its directors are regional scientific and business leaders, and in order to assist in financing technology commercialization and supporting new ventures, it created and maintains a close working relationship with the Long Island Venture Fund. During its lifetime, LIRI has concentrated successfully on three kinds of activities: technology commercialization, project design and management, and contract research of an analytical or supervisory nature. These attributes made LIRI the ideal collaborator for BNL in fulfilling its commitment to the Enterprise concept.

This view was enthusiastically shared by Dr. Frank, and funding for NEWME began in late FY 1993. A business plan and subsequently a strategic plan (Attachments 2 and 3) were prepared by NEWME principal investigators, and were endorsed by the DOE EM50 OTD so that by mid-FY 1994, NEWME was able to begin its operations in earnest.

However, during that same time period, major organizational changes in EM were proposed by Dr. Frank, as embodied in the report describing "A New Approach," issued on January 25, 1994. With the assistance of his Strategic Laboratory Council (SLC), Dr. Frank had developed a plan for integrating the somewhat autonomous site remediation activities throughout the DOE complex by creating Focus Areas representing the generically similar remediation problems, e.g., landfill stabilization, contaminant plumes, mixed waste, etc. Oversight panels would monitor the progress of these teams, and Site Technology Coordinating Groups (STCG) would ensure that the teams were fully integrated between stakeholders, customers, users , contractors, principal investigators, and any others thought to be needed to address a particular problem. The need for a new approach was perceived as arising from the lack of communication that accompanied the spectacular growth of the cleanup program when the Congress began its massive annual funding of the environmental restoration and waste management program at the beginning of this decade. The success of the new approach, on the other hand, was based upon the premise that the existing organizational structures would be willing to transform themselves into the new elements mandated by the new approach.

At this time EM50 had undergone a reorganization, and NEWME's program manager was Paul Longsworth, with continued informal assistance by Peter Ritzcovan. Mr. Longsworth had a clear vision of the Enterprise concept, and enthusiastically embraced NEWME's business and strategic plans.

That these events and assumptions had great relevance to the functions of NEWME (and its counterparts in other regions of the country) should be apparent. The success of the Enterprise concept required that it function in close harmony with the Focus Areas and the STCGs. But these elements of the New Approach were slow to organize during the FY 1994-95 time period, largely because they were already in the midst of hard and often delicate negotiations with regulatory agencies and contractors. Some sites had Records of Decision (RODs) in place that had well-defined timetables for deliverables; hence there was no incentive to reorganize or employ new technologies. This slow pace was a major obstacle for NEWME to overcome, and during this time period the Enterprise was unable to make the kind of alliances that were necessary to obtain agreement on technical needs, outstanding unsolved problems, or commercialization actions of any of the focus areas.

That this situation was more than a NEWME problem was confirmed when a workshop was convened in January 1995 to discuss and clarify the role of the STCGs in the new approach. The seriousness of the organizational difficulties at the time was emphasized by Assistant Secretary Tom Grumbly , whose spirited extemporaneous presentation set the tone for the remainder of the workshop.

At the beginning of FY 1996 NEWME's project manager was David Berg, who quickly understood the problems of the Enterprise, and convened a workshop at DOE, Germantown to rekindle the national effort originally envisioned by Clyde Frank. Berg endorsed and facilitated the decision by NEWME to team with the GETE, a major EM50 contractor. A plan was developed with GETE to approach the Westinghouse Savannah River Site (SRS) staff that had the lead role in the Contaminant Plume Focus Area.

GETE's contract with EM placed it at the center of the Enterprise program with missions to create an information database, GNET, to provide assistance to appropriate businesses in the environmental field, and to facilitate interactions between relevant businesses and the elements of the DOE EM establishment that require new cleanup technologies. These missions have been interpreted to include a GETE task that involves the coordination of the national Enterprise.

NEWME already enjoyed a close working relationship with the Global Environmental Technology Foundation and its for-profit spinoff, GETE, that had originated in the joint planning and successful execution of the Moscow 94 venture to reach out to untapped FSU environmental technology resources. Therefore, in early FY 1996 it was decided to renew this effective teaming arrangement in an effort to overcome the resistance of the focus areas. In order to concentrate its efforts, NEWME and GETE jointly decided to approach the Landfill Stabilization Focus Area centered at the SRS. Berg endorsed this approach, and NEWME's FY 1996 Technical Task Plan was modified to reflect activities to be conducted in this regard.

As a consequence of the events described above, certain actions were taken and NEWME is able to report accomplishments in FY 1996 which, though modest, illustrate how the aims of the original Clyde Frank initiative might be achieved. This manuscript also serves as a final report, so it is appropriate to briefly summarize NEWME's accomplishments initiated in earlier fiscal years but continuing through FY 1996, elaborating only upon those concluded or stopped for fiscal reasons during its final year.

Example of the NEWME Commercialization Process

While waiting for the situation within EM to stabilize, NEWME was successful in implementing its commercialization strategy on several BNL technologies.

Under a CRADA with Environmental Solutions Corporation, a Long Island wastewater treatment company, BNL co-developed a new bioreactor that recently received an award from Popular Science Magazine as one of the 100 best inventions of 1996. LIRI developed the original business plan for this company, and helped to secure $300,000 in seed capital. LIRI recently wrote an updated business plan for Environmental Solutions, which will raise a second round investment of approximately $5M. The company is poised for rapid market expansion in 1997, and will generate significant royalty revenues for BNL (and Associated Universities, Inc.) as a result of this collaboration.

LIRI developed the commercialization strategy and wrote a commercialization plan for BNL's biocatalytic method for upgrading sour crude oils. The plan recommended the creation of a new company, Biocat, which has now been formed. Biocat is envisioned as a holding company for the intellectual property and as a vehicle to maximize the utilization of this government-supported technology. The company is currently discussing collaborative demonstrations with several major petroleum companies.

FY 1996 Technical Task Plan (TTP)

In its ongoing efforts to be responsive to the EM50 Office, NEWME worked with its program managers to achieve a final version of its FY1996 TTP that accurately reflected current policy in the OTD, with respect to the goals of the Enterprise. Verbal agreement had been achieved with our previous program manager (D. Berg). Tasks and their priorities were revised in a later version of the TTP, and were discussed with and verbally approved by NEWME's fourth program manager (T. Parker). On the basis of these agreements, NEWME was able to proceed toward its objectives during the funding period to the extent that this was possible without further support from DOE headquarters. The NEWME version of the modified FY 1996 TTP is Attachment 4 of this report.

Teaming with the Global Environmental Technology Enterprise (GETE)

NEWME developed and maintained a close working relationship with GETE through Sam Meacham and Victor (Tori) Failmezger, to coordinate the development of a technology screening methodology, and to review relevant remediation technologies. The rationale for teaming with GETE early in FY 1996 has already been discussed in the Background section of this report.

A screening process was developed independently during this period by GETE and NEWME, and the two were combined into a GETE document prepared by Victor Failmezger. The NEWME version was published as LIRI Report 95-003, and is Attachment 5 of this report.

It is worth mentioning that the teaming strategy proved effective in facilitating application of the technology screening process to Savannah River Site technologies (see next section).

Savannah River Site and the Technology Screening Process

In order to move the Enterprise process forward, it was necessary as a first step to identify and establish a working relationship with at least one Focus Area. NEWME chose the Landfill Stabilization Focus Area with the assistance of program manager David Berg.

Through a sequence of working meetings in various locations (DOE Headquarters, SRS, LIRI, BNL) and conference calls, a plan evolved for EM40 at SRS to provide the GETE/NEWME team with lists of technologies to be screened for their commercial and utilization potential. It should be stressed at this point that the term utilization is employed to emphasize that the true metric of success in the commercialization process is that a technology actually became incorporated into the work plan on DOE sites in response to identified needs on those sites.

Problems exist with respect to parallel activities within EM50 concerning screening of technologies for purposes similar to those of the Enterprise. An existing method known as TechInvest seems to have been adopted at one time, then rejected, then readopted during this period. NEWME staff had technical discussions with many individuals who were funded by EM50 to either adapt or use TechInvest. It was concluded that the existing version of TechInvest was neither relevant to the technology commercialization process, nor relevant to NEWME's mission, and thus no effort was made to compare TechInvest to the GETE/NEWME screening process.

To do so would have further delayed NEWME's work without contributing to the resolution of the diverse opinions concerning the value added of the TechInvest approach.

The first action taken by the SRS/GETE/NEWME collaborators was to consider a group of ten technologies for screening. Five of these were reviewed by GETE and the following five were examined by the NEWME group:

1. PURUS (now owned by the Thermatrix,Inc.) PADRE VOC treatment.

2. CORONA off-gas treatment (a PNL technology)

3. Passive soil vapor extraction

4. Barrier technologies (undergoing field applications at BNL)

5. An off-gas treatment process of NEWME's choosing.

Evaluations of the first four technologies are provided in Attachment 6 of this report. Generally, it was found that significant efforts, supported by EM50, had already been expended to demonstrate these technologies at one or more DOE sites (e.g., at the Savannah River Arid Site Demonstration project). Moreover, most were found not in need of commercialization assistance, *per se*. Rather, assistance was required to convince EM30, 40, and 60 personnel at DOE sites to implement the technologies in their remediation programs.

NEWME expresses its gratitude to Jack Corey and Gerald Hooker of SRS, who made a special effort on NEWME's behalf to serve as a conduit to the EM40 staff at Savannah River, and to convince them that the cost-free screening of technologies chosen by them could add value to their own commercialization initiatives. Numerous meetings and conference calls were held during FY 1996 between these two gentlemen and the NEWME/GETE staff; without their support the Enterprise could not have made progress.

During FY 1997 NEWME expected to continue this effort, and to receive up to 20 additional technologies from SUBCON for evaluation and possible commercialization assistance. Unfortunately FY 1997 funding was not provided, and this activity ceased.

Additional NEWME Accomplishments through FY 1996 (inclusive)

- Search for technologies formerly funded by EM50.

  This activity was expected to result in finding technologies which were abandoned for non-technical/economic reasons, but which had potential for rapid commercialization. A search of the Remedial Action Program Information Center (RAPIC) database yielded more than a megabyte of information. NEWME's DOE program manager (Tom Parker) offered to obtain information on formerly EM50 funded technologies from the Waste Policy Institute (WPI), though unfortunately no information was forthcoming.

- Commercialized BNL-developed water treatment technology

  NEWME, through its LIRI partner, obtained venture capital for a licensee of an innovative biological water treatment technology developed at BNL. LIRI is currently assisting the licensee with national expansion and second-round financing.

- Evaluation of environmental technology databases.

  TechInvest: primarily a database management system (i.e., structure) searchable via key words, with unknown user friendliness. Touted with milestone and budget tracking capabilities, EM50 is funding LITCO to develop a risk-based algorithm (i.e., preference tree) for TechInvest to select site restoration technologies. The WPI is being funded to develop a technology data base to interface with TechInvest, and to program LITCO's algorithms. NEWME tried unsuccessfully on several occasions to obtain access to this technology information. TechInvest is not presently useful for purposes of evaluation and commercialization of remediation technology, and may not be ready for an additional 2-3 years.

  TechCon (Argonne National Laboratory): contains a multitude of information on many technologies, though with few descriptors of technologies specifically funded by EM50. User friendliness unknown.

  Remedial Action Program Information Center (RAPIC; Oak Ridge National Laboratory): a keyword searchable database of a large number of remedial technologies. User friendliness unknown.

  GNET: provided by the GETE through EM50 funds, GNET is accessible through the worldwide web, and contains useful information on generally available cleanup technologies. It lacks information identifying technologies which may have been funded by DOE.

- In cooperation with Parsons Environmental, NEWME facilitated tests of a BNL uranium extraction process for treating high-clay soils from the RMI site. Using RMI soil samples, the technology was found to be effective for removal of U-235 and Tc-99.

- NEWME supported the verification of a BNL ash encapsulation technology using virgin polyethylene, with potential use of recycled plastics (thus also enhancing waste minimization).

- In collaboration with (and with funds from) the National Center for Manufacturing Sciences, NEWME completed development of a program plan to promote and facilitate the recycling of durable goods containing plastics. This was planned as a 5-year program on recovery, characterization, and reuse of durable plastic materials, and was joined by 12 major companies, the American Plastics Council, the New York State Department of Economic Development, and several universities.

- In collaboration with the State University of New York at Stony Brook, NEWME supported the evaluation of pyrolysis technologies with applicability to DOE site remediation needs. A comprehensive evaluation was published (BNL Report 52452).

- NEWME participated in the organization and direction of the NYS Environmental Business Association, a rapidly growing network of environmental technology and remediation companies.

- In collaboration with the Global Environmental Technology Fund, NEWME completed the evaluation of several potential environmental remediation technologies developed in the FSU. Agreements with developers of nine FSU technologies were made at the Moscow 94 conference sponsored by EM50..

SUMMARY AND CONCLUSIONS

The Northeast Waste Management Enterprise was created in response to Dr. Clyde Frank's vision of a new partnership between research, industrial, and financial sectors. This partnership's mission was to speed development and use (particularly at DOE facilities) of environmental remediation technologies. As a byproduct, the partnership would also strength the international competitiveness of the U.S. environmental industry.

Since its inception at the end of FY 1993, NEWME has had several significant accomplishments in meeting its original business and strategic plans. During FY1996, NEWME staff developed a technology commercialization screening methodology which was successfully merged into the Global Environmental Technology Enterprise's technology selection and review process. NEWME staff also reviewed technologies provided by SUBCON, finding that most did not require commercialization assistance, *per se*, but rather assistance to introduce the technologists to EM30, 40, and 60 personnel at various DOE sites for implementation. In addition, NEWME evaluated several environmental technology databases of potential use to DOE environmental site managers. An important task which remained uncompleted was a search for technologies formerly funded by EM50 which were abandoned for non-technical/economic reasons.

Accomplishments prior to FY 1996 include working with a private corporation to facilitate tests of a Brookhaven National Laboratory uranium extraction process for treating high-clay soils from the RMI site; verifying a BNL ash encapsulation in virgin polyethylene; assisting the National Center for Manufacturing Sciences in developing a program to promote and facilitate recycling of durable goods containing plastics; publishing a comprehensive evaluation of pyrolysis technologies; evaluating of Former Soviet Union environmental technologies; and participating in the organization and direction of NYS Environmental Business Association, a rapidly growing network of environmental technology and remediation companies.

NEWME's (and the Enterprises) successes were constrained by two fundamental difficulties, one conceptual, the other organizational. The Enterprise concept required that it focus on the immediate needs of its primary customers, EM30, 40, and 60. Representatives of these organizations at DOE sites were already in the midst of difficult and protracted negotiations with regulatory agencies and contractors. Most DOE sites already had RODs in place that contained well-defined timetables for remedial actions, requiring immediate application of cleanup technologies. Technology development and commercialization required a commitment of precious time and effort, and thus EM50 and its Enterprise concept were fundamentally out of synchrony with the needs of other EM operations.

In addition, the Focus Areas and the STCGs were slow to organize during the FY 1994-95 time period. Unfortunately, these obstacles were impossible for the Enterprise and NEWME to overcome. Neither were able to make the kind of alliances that were necessary to obtain agreement on technical needs, outstanding unsolved problems, or commercialization *actions of* any of the focus areas.

In essence, it must be concluded that the Enterprise concept was valid but premature, and could only have succeeded with the complete support of all operating components of the Environmental Restoration and Waste Management Program (ERWM), including staff in the Office of Technology Development (EM50), and especially in EM30 and EM40.

Recommendations

- Commercialization of environmental technologies is a complex process. EM has undertaken several approaches to this task, and has realized some successes. **At this time, it would be beneficial to conduct a review of EM commercialization activities over the past few years to determine which approaches have been the most cost effective, so that the commercialization can be consolidated to meet tightening budget constraints.** *NEWME could now function as an impartial reviewer to perform that review.*

- EM50 has invested significant funds to develop innovative environmental remediation and waste management technologies. Many of these projects were terminated for unknown reasons. **To recoup at least part of these investments, it is critical to review such technologies for possible commercialization and use at DOE facilities.** *This activity already exists in NEWME's latest workplan.*

- Commercialization cannot be an afterthought to the technology development process. EM has made considerable progress in inserting commercialization requirements into the TTP process, but NEWME has found that most PIs do not have the background to undertake commercialization activities. Technology transfer offices at national laboratories are equipped to handle patenting and licensing, but do not have capabilities to structure and assist new ventures, strategic partnerships or other creative approaches. To succeed with commercialization EM must either develop these capabilities in its own staff or hire an appropriate contractor. *The LIRI-BNL partnership was formed to provide this capability, and has a successful track record in commercializing DOE-supported technologies, and can assist EM in future efforts in this area.*

- Based on meeting customer needs and using modern business measures, EM50's technology development efforts have largely been unsuccessful. **EM50's fundamental role should be changed to identifying potentially useful technologies (either proposed or currently available) to meet needs provided by DOE elements directly involved in site remediation and waste management. Personnel within EM30,40,60, rather than within EM50, should evaluate the relevance of such technologies to their actual needs, and should be relied upon to develop the relevant DOE marketplaces. Commercialization assistance, per se, should not be provided by EM50, but rather by other government agencies (e.g., DOE Office of Technology Transfer and the Small Business Administration). EM50 could then implement actual commercialization assistance through contractors who are better able to carry out these activities.**

Attachment 1

Original LIRI Contract and Final Extension

ACCOUNT NO	OBJ CLASS	LE NO	JOB/WK ORD NO	AMOUNT	COMM CODE	FISCAL YR.	UNDER DHS TION NO 1	BNL	CONTRACT NUMBER
				$77,899.00					7250
							S/D CODE	VENDOR NAME Long Island Research	
							VENDOR CODE		
TRANS CODE 09	BUYER CODE 10	BUYER NAME K. J. Fox		DATE OF CONTRACT 4/4/94			DATE OF EXPIRATION 9/30/94		REF NO

BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.
UPTON, L.I., N.Y. 11973

TEL. NO 516-345-2123 TWX NO

Long Island Research Institute
110 Lake Avenue South
Suite 35
Nesconset, NY 11767-1071

Attention: P. F. Palmedo

CONTRACT

This is a Contract (the "Contract") made as of the date set forth above, between the party above named (the "Contractor") and Associated Universities, Inc. ("Brookhaven"), the latter acting under Prime Contract No. DE-AC02-76CH00016 with the United States of America (the "Government") represented by the United States Department of Energy ("DOE"):

Hereto attached and hereby made a part hereof is Attachment A, which contains additional provisions of the Contract.

1. SCOPE OF WORK: The Contractor shall assist Brookhaven in formulation of the Northeast Waste Management Alliance (NEWMA). The purpose of this Alliance is to accelerate the emergence of a highly-competitive waste management industry.

Specifically, the Contractor's responsibilities will be to perform the following Tasks:

Task 1: Prepare a Draft Strategic Plan

The Contractor shall prepare a Strategic Plan that will identify and set priorities among critical waste management technologies, identify obstacles to strengthening competitiveness, outline the actions needed to overcome those barriers, and define a strategy for implementing those actions in a cost effective and rapid manner. The Strategic Plan will detail the steps which must be taken to form the Northeast Waste Management Alliance. It will describe the methods to be used in identifying potential partners in the Alliance, the process by which they will be recruited, and the organizational structure that will integrate them into a cohesive unit with a well-defined and mutually understood mission, viz., the creation of a strong, highly-competitive waste management industry for the northeast and ultimately for the entire United States of America.

Task 2: Identify Critical Technical Waste Management Problems, and Technology Evaluations

The Contractor will organize and manage meetings between representatives of industry, government officials at all levels and technologists from laboratories and academic sector for the purpose of identifying the most pressing technical problems now facing the waste management industry. This series of meetings will be repeated from time to time in order to ensure the timeliness of Alliance activities. The meetings will result in a prioritized list of proposed technical solutions.

In addition, the Contractor will participate in the screening of the initial technologies and technology-bearing companies who will be supported by NEWMA in the effort to bring these technologies and companies to technical and commercial viability.

The Contractor will also assist in the development of criteria for the selection of innovative technologies for further field evaluation.

Task 3: Development/Acquisition of a Waste-Management Knowledge Data Base

The Contractor shall assist Brookhaven in the assembly of the necessary information pertinent to the solid waste management industry for the purpose of identifying potential Alliance participants, contractors, and advisors.

It is anticipated that as the scope of work evolves, a need for subcontractors and consultants shall arise. If and when this requirement is clearly identified, the Contract shall be modified in accordance with paragraph 4.B. below.

This work is more fully described in pages 1, 2 and 3 of the Contractor's proposal dated August 30, 1993 which are incorporated herein by reference.

1.A. **REPORTS/DELIVERABLES:**

The Contractor shall deliver the following:

1. Draft strategic plan by 5/31/94.
2. Monthly letter reports summarizing activities
3. Final report summarizing activities by 9/30/94.

2. **TERM:**

This Contract shall be in effect the date executed by Brookhaven and shall remain in effect until September 30, 1994.

3. **ESTIMATED COST, COMPENSATION, AND PAYMENT:**

A. **Estimated Cost:** The estimated cost of this Contract is Seventy Seven Thousand Eight Hundred Ninety Nine Dollars ($77,899.00). This amount is obligated and authorized. The Contractor shall not be reimbursed in excess of this amount without written authorization from Brookhaven's Division of Contracts and Procurement.

B. **Compensation:** Payment of allowable costs as hereinafter defined shall constitute full and complete compensation for performance of work under this Contract. Payment by Brookhaven under this Contract on account of allowable costs shall not in the aggregate at any time exceed the amount obligated with respect to this Contract.

C. **Allowable Costs:** The allowable costs of performing the work under this Contract shall be the costs and expenses (less applicable income and other credits) that are actually chargeable either as directly incident or as allocable through appropriate distribution or apportionment, to the performance of the Contract work in accordance with Article III.1 (Allowable Cost and Payment) of Attachment A.

D. **Payment:** Payment will be made monthly upon receipt and approval by Brookhaven of properly certified invoices that set forth the costs incurred during the preceding month. The final invoice must be submitted within 60 days of expiration of the Contract.

Invoices, in duplicate, shall be forwarded to Brookhaven's Accounts Payable Section, Contracts Division, Bldg. No. T-134B. In order to fully comply with this clause, the Contractor shall submit the Attached "Statement of Cost" or equivalent with each invoice. In addition, the Contractor shall indicate the final invoice by clearly marking such invoice as "FINAL".

4. **BROOKHAVEN REPRESENTATIVES:**

A. **Technical:** Brookhaven's technical representatives for technical performance by the Contractor shall be A. Goland and E. Kaplan. They shall act as liaison between Brookhaven and the Contractor.

B. **Contractual:** Any questions of a contractual nature, including changes, should be addressed to Mr. K. J. Fox, Contracts Specialist, Telephone No. (516)282-2766. Any change or modification in the terms and conditions of this contract shall require the written approval of Brookhaven's Contracts and Procurement Manager, or her designee.

5. <u>KEY PERSONNEL:</u> Mr. Philip F. Palmedo shall be considered the Contractor's Key Personnel under this Contract.

6. <u>ADDITIONAL PROVISIONS:</u> Attachment A (General Provisions, Research and Development Contract with Educational Institutions and Non-Profit Organizations Form 2732, dated 11/91 with Rights in Data - Special Works), which is attached hereto and made a part hereof, sets forth additional provisions of this Contract. Attachment B (Organizational Conflicts of Interest - Special Clause) is attached hereto and shall apply.

7. <u>CONTRACT CLOSE-OUT REQUIREMENTS:</u> In accordance with this Contract, and in order to comply fully with all applicable cost and Government Property articles as contained in Attachment A, the Contractor shall complete and submit the following: Summary Settlement Statement, Final Release, Assignment of Credits, Refunds, Rebates, Etc., Property Clearance, Patent Clearance, Certification Regarding Application of Proceeds from Refunds, Rebates, Credits, Etc., and Equipment Acquired Report Form - Accountability and Disposition.

This Contract does not bind nor purport to bind the Government of the United States.

ACCEPTED:

LONG ISLAND RESEARCH INSTITUTE	ASSOCIATED UNIVERSITIES, INC.
By: [signature]	By: [signature] M. F. Healey
Title: PRESIDENT	Title: Manager, DCP
Date: 3/31/94	Date: April 4, 1994

The Contractor shall sign two (2) copies of this Contract and return two copies to the attention of Mr. K. J. Fox, Contracts Specialist, Division of Contracts and Procurement, Contracts Section, Building No. 355. One fully executed copy of the Contract shall be returned to the Contractor.

KJF:tb#7

PROPOSAL TO

BROOKHAVEN NATIONAL LABORATORY

for continuing management tasks
related to

THE NORTHEAST WASTE MANAGEMENT ENTERPRISE

April 23, 1996

Philip F. Palmedo, President

LONG ISLAND RESEARCH INSTITUTE
110 Lake Avenue South
Nesconset, NY 11767

The work proposed here is an extension of that performed under the current contract between Brookhaven National Laboratory and the Long Island Research Institute (LIRI), Number BNL 725003, to implement the Northeast Waste Management Enterprise (NEWME). At the request of DOE, this effort is now focussed on the selection, screening and evaluation of technologies in support of the DOE/EM combined Plumes and Landfill Focus Area, also referred to as the Subsurface Contamination Focus Area, SCFA.

WORK PLAN

TASK 1. Strategic Planning and Program Management

This will be a continuing activity carried out in cooperation with BNL. The objective is to optimize the benefits of NEWME's program to DOE's Office of Environmental Management: Technology Availability. Work under this task may involve planning and analysis in collaboration with staff of other national laboratories, the SCFA, other DOE officials, and the Global Environmental Technology Enterprise. It may include travel to Washington and other DOE sites.

TASK 2. Technology Evaluation

To be carried out in cooperation with BNL, this task will involve:

Task 2.1 Evaluation Criteria

The screening process developed by LIRI during the previous contract period will be updated and refined as needed.

Task 2.2 Evaluation

LIRI will support BNL in its evaluation of SCFA technologies starting with those identified as priority technologies by focus area staff. This process may include as appropriate the following considerations:

(a) possession of intellectual property rights,
(b) degree of tehcnological maturity,
(c) capability of the company to successfully implement the technology,
(d) potential environmental, safety, and health impacts,
(e) the potential impact of the technology on EM cleanups,
(f) public acceptance where determined as necessary, and
(g) such other criteria as may be identified during the screening process.

TASK 3. Commercialization Assistance

At the conclusion of Task 2, one or more technologies may be identified for commercialization assistance. In this task we will develop the plan for those assistance activities, including budgets.

DELIVERABLES

1. Monthly progress reports
2. Technology Evaluation Reports on selected technologies
3. Commercialization Assistance Plan - three weeks following completion of technology evaluation.

SCHEDULE AND BUDGET

The budget for the program is given in Table 1.

CONFLICT OF INTEREST

No new facts exist that require an amendment to the original conflict of interest statement submitted for this contract.

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BROOKHAVEN NATIONAL LABORATORY

MEMORANDUM

Date: May 8, 1996

To: E. Fredrickson

From: A. Goland/E. Kaplan

Subject: Extensions/revisions to LIRI contract

Please extend our existing NEWME contract with LIRI to September 30, 1996, at the level of $50K, subject to a spending cap of $10K per month. During this period, LIRI will assist NEWME in strategic planning, program management, and selection, screening, and evaluation of technologies in support of the DOE/EM Combined Plumes and Landfill Focus Area (Subsurface Contamination Focus Area, SCFA). Charges should be divided equally between projects 05223 (DAS) and 13226 (DAT).

Tasks:

(1) During this period of time LIRI will engage in strategic planning and program management, and will focus on technologies identified in discussions with the SCFA and the Global Environmental Technology Enterprise.

(2) LIRI will assist in the development of evaluation criteria, and will screen technologies using the screening process developed by NEWME during the previous subcontract period. This process includes but is not limited to the following considerations:

(a) possession of intellectual property rights,

(b) degree of technological maturity,

(c) capability of the company to successfully implement the technology,

(d) potential environmental, safety, and health impacts,

(e) the potential impact of the technology on EM cleanups,

(f) public acceptance where determined as necessary, and

(g) such other criteria as may be identified during the screening process.

(3) For those technologies deemed to have high potential for implementation, LIRI will assist in the development and implementation of an assistance plan.

Deliverables:

(1) Monthly progress reports,

(2) technology evaluations, and

(3) an implementation assistance plan, two weeks after completion of each technology evaluation.

cc: A. Fridae
B. Penn

Attachment 2

NEWMA Business Plan

BUSINESS PLAN

for the

NORTHEAST WASTE MANAGEMENT ALLIANCE

AUGUST 1, 1993

Brookhaven National Laboratory
Upton, N.Y. 11973

Long Island Research Institute
Setauket, N.Y. 11733

THE NORTHEAST WASTE MANAGEMENT ALLIANCE

BUSINESS PLAN

1. Executive Summary

The Northeast Waste Management Alliance is a new form of partnership whose goal is to increase the economic, commercial, and environmental effectiveness of solid waste management (SWM) in the Northeast region of the U.S., through implementation of new technologies. This goal will be achieved by bringing together the relevant talents and expertise now existing in the Northeast to trigger the emergence of a highly-competitive waste management industry, first locally on Long Island under the umbrella of the not-for-profit Long Island Research Institute (LIRI), then regionally, and finally nationally as well as internationally.

The Alliance has already identified potential candidates in the waste management industrial sector. The next step will be to evaluate each technology prior to the establishment of a field program to demonstrate its merits. This validation and verification process will take place with each industrial partner. A concurrent economic analysis will take place shortly after the beginning of the field program, which, together with technical evaluations, will form the basis for decisions relating to the ultimate commercialization of the technology.

2. Background

2.1 The Waste Management Problem

Perhaps the most important, long-term environmental problem facing the Northeast during the next decades is what to do with the massive amounts of municipal and industrial waste generated daily. This region of the country has the highest population density, consumes more energy than any other part of the nation, and produces more waste while possessing fewest sites for their disposal. While the Northeast may be the best region for addressing this problem, the problem of municipal and industrial waste is a rapidly-growing concern in the rest of the country and throughout the world. Thus, competitive, effective solutions arrived at in the Northeast can form the basis of world-wide commercial activities.

The strategy addressed in this plan is the redefinition of solid waste as a resource, and conversion of this resource into marketable products by a viable commercial industry.

2.2 Concept of the Alliance

In October 1992, in response to a request from the Department of Energy, the National Laboratories formed the Strategic Laboratory Council (SLC) to carry out integrated planning to guide future investments in technological solutions to environmental restoration and waste management problems facing DOE and the Nation. An important SLC recommendation was the establishment of The Alliance, a new organization to facilitate interaction among DOE Laboratories, industry, and universities. The objective was to create an environment for cooperative development in key technology thrusts and cross-cutting technologies.

During March 8-9, 1993, the Deputy Assistant Secretary of the DOE's Environmental, Restoration and Waste Management Program attended a workshop at BNL to discuss the Alliance concept as it pertained to the Northeast. With the environmental and waste management problems discussed in the previous section as a background, it was decided to bring together the diverse talents now existing in the Northeast to trigger the emergence of a highly-competitive waste management industry, first locally, then on a regional basis and finally, nationally as well as internationally.

A meeting of the Northeast Waste Management Alliance (NEWMA) was held on May 7, 1993, at the SUNY/Stony Brook Campus under the sponsorship of LIRI. Attendees included representatives of the SWM industry, including a firm which is perhaps the preeminent source of information to the SWM industry, as well as the Commissioner of SWM for the Town of Brookhaven (the largest political entity on Long Island, with a population in excess of 400,000). Several key needs of the industry were defined which spanned the gamut of waste stream separation, recycling and reuse, incineration, and landfilling. Several applicable technologies were identified which could serve as initial examples for technical and economic evaluation by NEWMA. Plans to implement NEWMA under the LIRI umbrella were also discussed.

LIRI will bring together publicly supported basic research with private entrepreneurial initiatives, with a goal of facilitating the commercialization of technologies that will be evaluated and developed. The participants will come from private industry, Federal laboratories, academia, government agencies at all levels, and the DOE.

3. The Alliance

3.1 Mission

The Alliance aims at the creation of an internationally competitive waste management industry for the United States. To realize that vision, a new form of partnership will combine the expertise and resources of government, the scientific and technical capabilities of the research community, and the financial and entrepreneurial resources of the private sector.

To accomplish this mission, NEWMA plans to eliminate or reduce many of the problems which prevent the germination of successful technology-bearing companies (i.e., "decontamination of the playing field"). These problems include loss of flow control, contradictory or unreasonable regulations, lack of cooperation between the public and private sectors, and siting problems due to questionable health/ecological risk perceptions.

NEWMA further plans to reduce the Region's reliance on landfilling by introducing new technologies. This engenders emphasis on the 'recover' portion of the hierarchy referred to in the SWM industry as "Reduce, Reuse, Recycle, Recover, Dispose." This is a controversial subject because, generally speaking, "Recover" means waste-to-energy. Much of the controversy surrounding waste-to-energy focuses on the perception that it is always better to recycle than to recover. The Alliance will evaluate this commonly held opinion, and bring the environmental entities participating in the Alliance into the discussion. In some cases, after serious evaluation and elimination of mere opinion (i.e., biases), enlightened thinking may show that recovery is a better environmental (and cost effective) solution than recycling.

3.2 Strategy

The overall strategy is to identify the needs of private industry and to upgrade the technological capability of the private sector. This will be accomplished by by taking advantage of the research and development capability of Federal laboratories (BNL in particular) and academia, with support and facilitation of the U.S. government, using the implementation capability of private industry, and venture capital from financial institutions.

Each of the participants in the NEWMA will perform a well defined set of functions. LIRI will be the coordinating organization. During the initial phase of the project, attention will be focused on Long Island, and LIRI will provide management and guidance from the pre-competitive stages of a project through its early commercial development. Various participants will work together at different times in this process. Some functions will be ongoing throughout the lifetime of a project as they are typified by long lead times. However, the expertise accessible to the participants will ensure rapid decision-making, e.g., in the early validation of a proposed technological advance. Other participants come from waste management professional organizations, as well as environmental groups. See Appendix A. The functions of the participants are outlined in Section 6 below.

Partnerships will be established with industries whose technologies relate to solid waste management issues defined by the enterprise, and which require facilities for controlled field evaluations. These technologies will be evaluated for their technical success and ultimate profitability. As technologies are commercialized a cash flow will be established through patents, licensing, and other arrangements. These funds will be fed back into the organization with the goal of making the enterprise a self-supporting operation.

At several recent meetings discussions have been held with representatives from the waste management industry to identify critical problems which might be solved by the application of new technologies. Criteria for candidate technologies include their flexibility and safety (i.e., can they be applied to waste management problems with a minimum of change or retrofit?), as well as their being technically and economically effective. Examples of problems and associated technologies which are deserving of the NEWMA's attention (including barriers to their development) are discussed in Section 7.

Access to real-time, up-to-date, high quality data relating to the SWM industry will be required. For example, in order to site or specify an appropriate SWM technology, information is necessary on waste flow, waste characteristics, legal background (e.g., what kinds of regulations are in place), flow control status, other technologies in place in an integrated system, participants (e.g., companies, public sector entities, individuals), NAAQS/PSD status, suitability of technology to situation, demographics of area, geographics of area, political aspects/considerations, funding requirements, funding availability, appropriate financing instruments, etc. Another activity involves the ability to simulate different waste management scenarios, based on various assumptions. Additional activities will focus on the 'flow' of waste, the type and composition of various waste stream components, and the current disposition of various waste forms. This information will be useful for both technical and economic evaluations of various candidate technologies.

4. The Market

4.1 Structure

The U.S. produces more solid wastes (both municipal and industrial) on a per capita basis (and in absolute terms) than any other nation. According to a recent EPA publication, approximately 180 million tons of municipal solid waste alone was produced in 1988, and the per capita production of solid wastes in the densely populated areas of the Northeast was estimated to be almost twice the national average.[1]

As the amounts of solid waste increase, the number of acceptable disposal options appear to be decreasing (for a variety of reasons, including economic, environmental, and political). This has resulted in a large and growing interstate traffic in solid wastes. It has been reported that in 1989, 43 states and the District of Columbia exported some solid wastes for disposal elsewhere.[2] New York and New Jersey are the most aggressive solid waste exporting states, accounting for more than 50% of the total interstate

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1. U.S. Environmental Protection Agency, "Characterization of Municipal Solid Wastes in the United States: 1990 Update," PB90-215112 (June 1990).

2. Schubel, J.R., and H.A. Neal, Garbage and Trash, Can We Convert Mountains into Molehills?, Monograph Series of the New Liberal Arts Program, Research Foundation of the State University of New York at Stony Brook (1992).

traffic in solid wastes in 1989 (neither state imports such waste)[3] Trucking waste long distances is uneconomical, wasteful of energy, and less attractive as a long term solution as fewer sites become available to accept wastes from elsewhere.

By act of Congress and international law, ocean disposal is no longer an option. A recent United Nations regulation aims at the elimination of all dumping of plastics from ships at sea, and the limitation of garbage dumping (and the discharge of floatables) by ships between 12 and 25 nautical miles from shore.

Fully integrated resource recovery systems are becoming more attractive as a solution to regional solid waste management, as are environmentally benign manufacturing processes.[4] However, as discussed in a recent seminal monograph, "The options for ultimate disposal -- for that fraction of the municipal [and industrial] solid waste stream that cannot be eliminated through source reduction, reuse, and recycling -- are limited to two: landfilling and incineration."[5]

Several of these difficulties can be addressed by the application of new and innovative technologies.

4.2 Specific Market Focus

The Alliance will focus on specific, high-priority problems facing the SWM industry. It is important to note that the effort will not be one of finding applications for promising technologies, but rather the evaluation and ultimate commercialization of technologies which address important near and far term SWM industry concerns. These problems will be reviewed periodically through the mechanism of workshops sponsored by the NEWMA, as well as through input from several advisory groups to the LIRI technical management team.

4.3 Available Resources

The role of Alliance coordinator is a natural one for the Long Island Research Institute. LIRI was created by Brookhaven National Laboratory, the State University of New York at Stony Brook and Cold Spring Harbor Laboratory as a non-profit entity specifically to commercialize technologies from research laboratories and to foster productive interactions between research

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3. Moore, A., "Interstate Movement of Waste," statement presented to the U.S. Senate Committee on Environment and Public Works Subcommittee on Environmental Protection (18 June 1991).

4. Such fully integrated solid waste management systems are in operation in several cities. In Akron, OH, for example, an RDF combustion, recycling, composting, and landfilling operation is operating as a result of public/private partnerships. The recycled energy system (RES) produces steam, hot water, chilled water, and electricity. The recycling facility processes commingled ferrous metals, aluminum, glass, plastics, and paper. Dewatered sludge from these processes are sent to a composting facility. Only non-processible solid waste, ash from the RES, and residue from the wastewater treatment plant are sent to a sanitary landfill. See Kapper, R., et. al., National Waste Processing Conference, The American Society of Mechanical Engineers, Book No. 100201, pp. 299-311 (1990).

5. Schubel, J.R., and H.A. Neal, op. cit.

institutions and industry. LIRI's Board of Directors and its Scientific and Business Advisory Council already include senior representatives of the region's technical, industrial and financial communities. Furthermore, LIRI's senior management have extensive experience in managing large scale multi-disciplinary technical projects.

Private industry is the central resource of the Alliance. They bring critical management, commercialization, and marketing skills as well as technologies that have been tested in the field.

Several important resources at DOE National Laboratories provide important strengths to the NEWMA. The Environmental and Waste Management Center in BNL's Department of Nuclear Energy has recognized expertise in areas related to mixed wastes. These include materials development for containment, encapsulation, and in-situ establishment of barriers. Researchers have also developed new technologies in groundwater and air pollution monitoring devices. Researchers in BNL's Department of Applied Sciences have developed ultra-low concentration perfluorocarbon tracers, and are investigating the role of naturally occurring microbes in waste degradation and transformation, and advanced materials development for landfill containment and corrosion resistance.

BNL's Technology Transfer Division is presently positioning itself to take full advantage of the Clinton/Gore Administration's thrust in cooperative research and development activities (i.e., CRADAs). Each CRADA represents a cooperative program between personnel at National Laboratories with those from the private sector. It is anticipated that some field demonstrations of new technologies will be funded through the CRADA mechanism, or through indirect funding via LIRI.

Technologies under development at other National laboratories will be explored through existing databases presently in use by DOE technology transfer activities, as well as other contacts (e.g., the SLC described in Section 2).

Involvement of various academic institutions will provide the additional expertise needed to ensure success of the Alliance. Personnel at the Waste Management Institute at SUNY/Stony Brook have collaborated with BNL staff in areas related to bioremediation and materials development.

Rensselaer Polytechnic Institute (RPI) now offers courses in nuclear waste management, waste management and environmental planning and analysis in several departments of the school. Other activities such as the Fresh Water Institute and the Center for Multiphase Flow also have relevance to waste management issues. Recognizing that a new class of professionals will be required to monitor compliance, and to ensure safe handling and disposal of waste materials, RPI and BNL have initiated a partnership with industry to address waste technology research and education applications. This organizational framework will facilitate and coordinate multidisciplinary interactions and projects to meet the needs of several segments of society, especially the need to develop a pool of engineers and technologists trained in modern waste management.

The Department of Civil and Environmental Engineering at Polytechnic University (Brooklyn, N.Y.) offers a hazardous materials management program which includes site remediation, ground water pollution, hazardous and toxic waste management, and environmental health engineering. BNL has proposed several collaborative educational programs with Polytechnic University in FY 1994.

The Center for Nuclear Chemical Technology (CNTC) in the Department of Nuclear Engineering at the Massachusetts Institute of Technology has the largest faculty and body of nuclear engineering graduate students in the United States. The Department's mission includes applications of nuclear technology in industry involves areas of radioactive waste, chemical process technology, and fundamental issues underlying interactions of chemical environments and materials and how these interactions affect engineered as well as natural systems.

The Waste Management Institute at Cornell University's Center for the Environment deals with a wide range of waste management issues such as waste reduction, reuse, recycling, incineration, and landfilling. In addition, the Solid Waste Combustion Institute is a totally independent entity at Cornell University, established by the New York State legislature in 1987. It performs research and development activities related to combustion technologies. Other Cornell facilities include a biotechnology program in biodegradation and bioremediation, and a laboratory for environmental applications of remote sensing.

4.4 Other Alliance Advantages

A unique virtue/capability which the Alliance brings to SWM is an integrated, dispassionate, and single-minded focus. The SWM 'universe' has been struggling with divisiveness and controversy for many years. The Alliance will succeed by mounting a high-level, broad-based effort to quell controversy and replace divisiveness with cooperation, while creating competitive private industries at the same time. It is perhaps true that nothing short of an Alliance-magnitude effort will be capable of making progress in such a complicated, difficult field.

In developing this plan, we have drawn on the knowledge and advice of people from various levels of government, the research community, and the private sector. It has been clear that there is a wide recognition not only of the problems of the waste management industry in this country, but also of the potential for a new partnership such as described here. The involvement of all members of the SWM community is a central strategy of the Alliance and a critical advantage.

The existence and role of the Long Island Research Institute is a further advantage. LIRI is an operating not-for-profit organization which already constitutes an effective bridge between the research, business and financial communities. Early in LIRI's evolution, the importance of seed financing was recognized. A technology-oriented seed capital fund is being created to work with LIRI. That fund, and its relationships with the broader

U.S. and overseas venture capital community, will be extremely helpful to projects developed by the Alliance.

5. Alliance Tactical Action Plan

The Alliance create competitive commercial ventures through the following actions:

5.1 Development/Technology Selection

By the application of a set of preliminary evaluation criteria we have identified several candidate technologies for full scale Alliance evaluation. These are described in Section 7 below. Each technology will be evaluated for inclusion in the Alliance program by requesting expression of interest and qualifications from industries active in the particular field. Integral to the evaluation will be commercial, economic, and financial feasibility. That process will be complemented by a review of the regulatory situation, government attitudes, environmental constraints, as well as applicable scientific and technical resources in academic and government laboratories, particularly within the region. Health and environmental implications of the technologies will be given serious consideration at all levels of this process. Ultimately this process will result in one or more technologies to take through the next steps; the identification of the specific industrial, laboratory and/or academic partners: the budget for the next phase; and a business plan for full commercial implementation of the technology.

5.2 Demonstration

Typically, we expect that each selected technology will require a demonstration. The demonstration will be a combination of technology (and management) already existing in industry; scientific and technical expertise from BNL, Stony Brook, and other academic and research institutions; and relevant governmental agencies. The objective of the demonstration will be:

To transfer technology from the research institutions to the corporate partners;

To prove technical feasibility at a commercial scale;

To establish economic parameters as a basis for a "bankable" business plan;

To establish environmental acceptability and the basis for any required regulatory approval.

5.3 Commercial Enterprise Formation

The commercial enterprise that will exploit the technology may consist of the private sector participants in the demonstration. Other entities may also be involved. It may be a single, existing company; it may be a consortium of existing companies; it maybe a new commercial entity. (Structural relationships and institutional roles are discussed in the next section.)

Depending upon the industrial partners, this step may also include raising of private venture capital.

5.4 Commercial Implementation

In the final phase, the commercial implementation of the technology, both at the demonstration site and elsewhere, will be in the hands of the private sector. There may be good reason, however, for a continuing role for the research community in this phase. One of the shortcomings of the environmental management industry in the U. S. is the lack of a strong research program. Thus far it is for the most part a "low tech" industry. Thus, the model of the National laboratories and the universities acting as the basic research arm of a U.S. waste management industry (at least during a transition period) is appealing. It is particularly so because waste management is also "low tech" internationally and a governmental-industry partnership designed to create a U.S. high technology waste management industry could have very significant commercial implications for the country.

The evolution of the project structure is shown in Figure 1. As indicated there, there is an evolution of a project from within the rather complex, but nurturing Alliance framework to a commercial entity indicated in Phase III by "Company A." The latter may be a pre-existing company or new company created by the Alliance or a joint venture of some sort.

6. Alliance Structure

As discussed above, the Alliance brings both new technical resources and a new organizational approach to the solid waste management problem. (Figure 2) The structure designed for the Alliance is intended to bring together effectively all of the elements required to overcome critical institutional and technical barriers. It is a structure that will evolve over time as specific initiatives of the Alliance progress. Figures show the current Alliance organizational structure.

The major participants, and their roles in the Alliance are:

1. Alliance Board of Directors

   - Formulates Alliance priorities
   - Approves projects
   - Facilitates high level government and industry interaction

2. Alliance Coordinator - Long Island Research Institute

   - Evaluates technology/project commercial viability
   - Provides overall management and coordination
   - Provides fiscal management
   - Stimulates participation in Alliance entity
   - Designates and supervises Program Managers of individual Alliance projects
   - Structures cost sharing and private sector investment in projects/commercial initiatives.

3. Alliance Advisory Board

   - (Drawn from all participating entities)
   - Advises on Alliance policy and projects
   - Mediates environmental/technical controversy
   - Facilitates networking between Alliance entities

4. U.S. Department of Energy

   - Provides funding of enterprise start-up
   - Provides near term co-funding of individual enterprise projects
   - Encourages state and local governments to strengthen as initiate low-cost loans and no-cost grants.
   - Creates favorable climate for enterprise in other federal agencies
   - Coordinates Executive Branch participation in Alliance projects

5. U.S. EPA

   - Identifies high priority problems/needs

- Facilitates regulatory acceptance of Alliance objectives
- Works with state and local agencies to resolve regulatory anomalies
- Provides co-funding for technology development
- Facilitates appropriate regulatory changes
- Regional EPA Office works closely with the new entity to anticipate regulatory barriers to rapid commercialization
- Advises entity management on environmental policy
- Makes available relevant EPA expertise overcome perceived obstacles to progress.

6. Private Industry

- Proposes new technologies/ideas to Alliance
- Implements projects based on new or improved technologies
- Provides incubator for new technology and company growth
- Provides feedback to Alliance on technology performance
- Provides portion of project funding via cash or "in kind" services
- Provides flow back to Alliance from successful projects

7. National Laboratories, BNL acting as coordinator

- Perform independent technical evaluation of proposed technologies
- Supply technologies for Alliance projects
- Develop data bases required by Alliance
- Conduct research in support of Alliance projects and commercial entities
- Supply facilities for project demonstration and supporting projects
- Conduct environmental technology training programs with academic collaborators.

8. Academia

- Provides research and general academic expertise
- Coordinates education and retraining within Alliance objectives
- Participates in technology evaluations
- Provides general peer review

9. Environmental Organizations

- Participate in policy formation
- Participate in health and ecological risk evaluations
- Participate in technology assessments
- Participate in siting assessments

10. Municipal Agencies

- Provide guidance for needed research
- Provide guidance for Alliance policy making
- Identify high-priority environmental/work management problems
- Lobby state government in support of Alliance objectives
- Facilitate regulatory acceptance of Alliance objectives
- Facilitate siting of test programs and projects
- Provide sites for test programs and projects
- Facilitate presentation of project goals to constituents
- Facilitate permitting of Alliance projects

11. State Agencies/Government

- Identifies high priority SWM needs
- Represents economic development interest of states
- Facilitates regulatory development and/or changes
- Facilitates test program siting and implementation
- Facilitates permitting
- Co-fund projects that accelerate commercialization

12. SWM Professional Organizations

- Provide guidance for needed research
- Inform Congress & White House in support of Alliance objectives
- Provide formal review of technology evaluations

13. SWM Industry Organizations

- Provide guidance for needed research
- Assist Alliance in evaluating of technologies
- Provide guidance for Alliance policy making
- Inform Congress & White House in support of Alliance objectives

In order to facilitate efficient and rapid start-up of the Alliance, it is expected that a private sector SWM consulting firm will be hired to support LIRI in the early project phases.

7. Specific Technical Foci

The first step in identifying the initial technologies for the Alliance was to establish a set of relevant criteria. These criteria were:

1. The significance of the problem addressed by the technology as perceived by major actors (public, government, scientific, community, etc).

2. The potential for major contributions by the application of new science or technology.

3. An Alliance undertaking (e.g., a demonstration project) can make a difference and is practical.

4. The application is economically and commercially attractive (i.e., there is a large market for the targeted product as revised).

5. The technology has relevance to DOE's environmental management problems.

On the basis of the application of these criteria, the following technologies have been selected for initial Alliance consideration:

Incinerator Ash Recycling: Several technologies are already available for evaluation. Barriers to commercialization are health/environmental risk concerns, lack of acceptance by project owners/engineers who specify material to be used in construction (e.g., materials containing incinerator ash need ASTM or other "official" specification and/or approval). There is a need to evaluate offshore use of materials for massive development projects, as well as for road building.

Waste Stream Characterization and Handling Technologies (also known as front-end separation): There is a widely recognized but largely unmet need for better ways to identify, track, and physically sort discards and recyclables. Some potentially attractive technologies include: (1)

automated high-tech equipment for sorting recyclables at MRF's and transfer stations into materials-categories that can be selected as markets for recyclables change, (2) mobile truck-mounted automated waste stream samplers to provide economical, real-time auditing and monitoring services to business, industry, and government, (3) materials tagging and identification technologies allowing manufacturers to encode materials information in their products in ways that integrate with the sorting and auditing technologies outlined above, and (4) containers and ancillary devices to facilitate residential and commercial source-separation, integrated with purpose-designed commercial collection equipment and schedules, and commercial waste-reduction technology.

Waste-to-Energy Technologies: refuse derived fuel (RDF) systems [e.g., front end separation with combustion of appropriate fuel components (e.g., refuse derived fuel)] need design improvements, but may have great potential for superior environmental and cost effective performance.

While other thermal processing technologies may be promising (e.g., composting, wet oxidation, pyrolysis), they have a history which includes many significant failures. Early waste-to-energy facilities created controversy because they had very high profiles (e.g., they were newsworthy) and because some of them performed poorly. The poor performance was environmental, technical and economic. Several facilities had serious odor and other "public nuisance" problems. The most serious environmental issues associated with these facilities relates to air pollution, especially air toxics (e.g., dioxins, heavy metals). However, newer facilities perform better than most other combustion facilities (e.g., coal fired utility boilers, various kinds of industrial boilers). The improved performance of the newer waste-to-energy facilities has not been generally recognized by environmental groups.

The mass burn technology has become the predominant waste-to-energy technology. However, the RDF technology, which has suffered from performance problems typical of the first attempts at innovative technologies, nevertheless has the potential of being a more superior SWM technology than mass burn. The Alliance will select various RDF technologies for evaluation. There may be other waste-to-energy technologies deserving of Alliance evaluation as well (e.g., destructive distillation, pyrolysis, etc.) - but only after serious screening to ensure that the Alliance is not promoting an impractical SWM solution.

Bio-Technology: Technologies in this area which may be applicable to SWM are at the R&D level at this time. Nevertheless, biotechnology should be considered for the purpose of (1) bioremediation, (2) controlling gas emissions (e.g., H_2S can be oxidized), (3) breaking down of cellulose-based products, and (4) creating biologically-derived solvents for plastics. Long Island is a strong biotechnology center (i.e., Cold Spring Harbor, SUNY, BNL).

Landfills: Recognizing the existence of the large numbers of both operating and closed landfills, most of which leach, two important technological goals include: (1) "shrinking" existing landfills by exploiting their resources, and then to restore the land for useful, beneficial purposes, and (2) diversion of wastes that otherwise would be destined for landfills in and beyond the Northeast.

Waste distillation systems appear promising for their (a) economy, (b) ability to handle a large fraction of the waste stream [e.g., paper, plastics, organics (yardwastes, food), agricultural wastes, tires], (c) huge volume and weight reduction potentials (+95% and 80%, respectively), and (d) relatively benign environmental impacts. In combination with landfill metal 'mining' technologies, waste distillators can reduce the size of landfills. Cogeneration systems can be integrated with the distillators. (The distillators also are promising for on-site processing of institutional wastes.) New landfill methane generation and recovery techniques can provide cogenerated electricity or fuel for alternative vehicles. Waste heat from the distillators or methane systems can be used in greenhouses, aquaculture, and commercial heating. Bulk plastics- and ash-based secondary materials and composites can be used as landfill cover, leachate barriers, and general landscaping/infrastructure materials.

A large fraction of the waste stream now being sent to landfills out of the region could be accommodated by waste distillators, with significant savings compared to the cost of shipment or of incineration. Waste distillation technology is flexible, allowing integration with recycling programs and facilities so as to maximize the level of recycling compatible with changing markets and applications for recyclables.

8. Financial Analysis

It is premature to be able to analyze the financial aspects of the Alliance in any detail. If one considers the three phases of the Alliance indicated in Section 6, however, several observations can be made. First, as one progresses from Development to Demonstration to Commercialization, the financial stakes increase roughly an order of magnitude between phases. As indicated in Table 1, the balance between federal and private financial involvement shifts dramatically. One of the principal activities in Phase I is to analyze the prospective financial performance of each competing technology. A detailed project-specific business plan leading to private involvement will be developed in Phase II.

TABLE 1

Alliance Notional Financial Participation

	Financial Participation, %		
PHASE	DOE,EPA	INDUSTRY	PRIVATE CAPITAL
I Development	80	20[a]	
II Demonstration	50	40[b]	10
III Commercialization	5[c]	30	65[d]

Notes:

[a]In-kind participation

[b]In-kind and financial

[c]Related research support

[d]Dependent on industrial financial capability

APPENDIX A

Professional Organizations

The Air & Waste Management Association
The American Public Works Association
The American Society of Mechanical Engineers' Solid Waste Processing Division
The Association of State and Territorial Solid Waste Management Officials
The Solid Waste Association of North America

Industry Organizations

The American Paper Institute
The American Plastics Council
The Council on Plastics and Packaging in the Environment
The Glass Packaging Institute
The Institute of Clean Air Companies
The Institute of Scrap Recycling Industries
The Integrated Waste Services Association
The National Solid Wastes Management Association

Municipal and Government Organizations

The American Legislative Exchange Council
The Coalition of Northeastern Governors
The International City/County Management Association
The National League of Cities
The National Association of Counties
The U.S. Conference of Mayors (sponsors the Municipal Waste Management Association)
The National Conference of State Legislatures' Solid Waste Management Project
The National Governors' Association (sponsors the Committee on Natural Resources which focuses on SWM issues)

Environmental Organizations

The Sierra Club
The United States Public Interest Research Group
The Environmental Defense Fund
The Natural Resources Defense Council
The Audubon Society

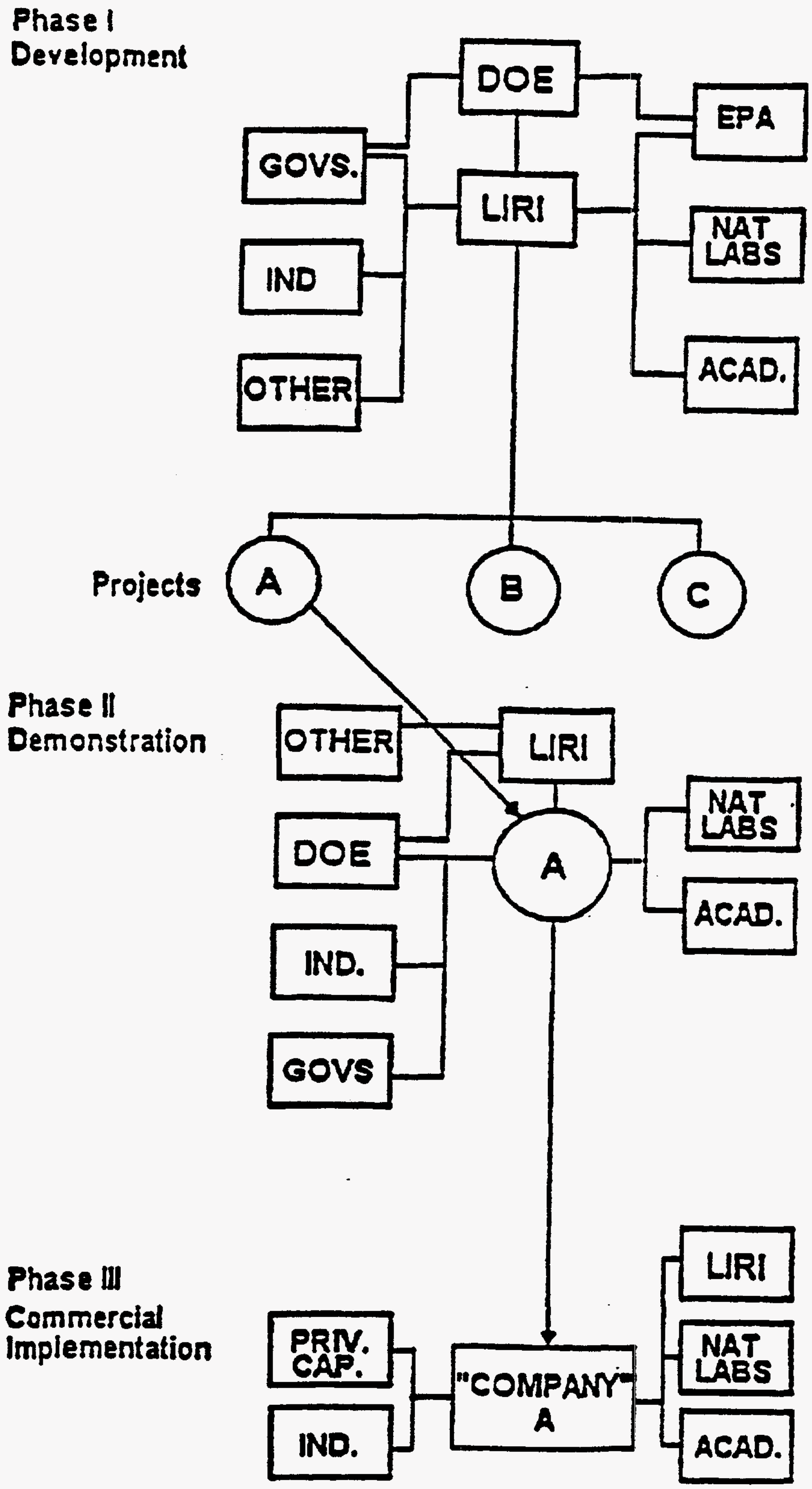

Figure 1 - Project Structure Evolution

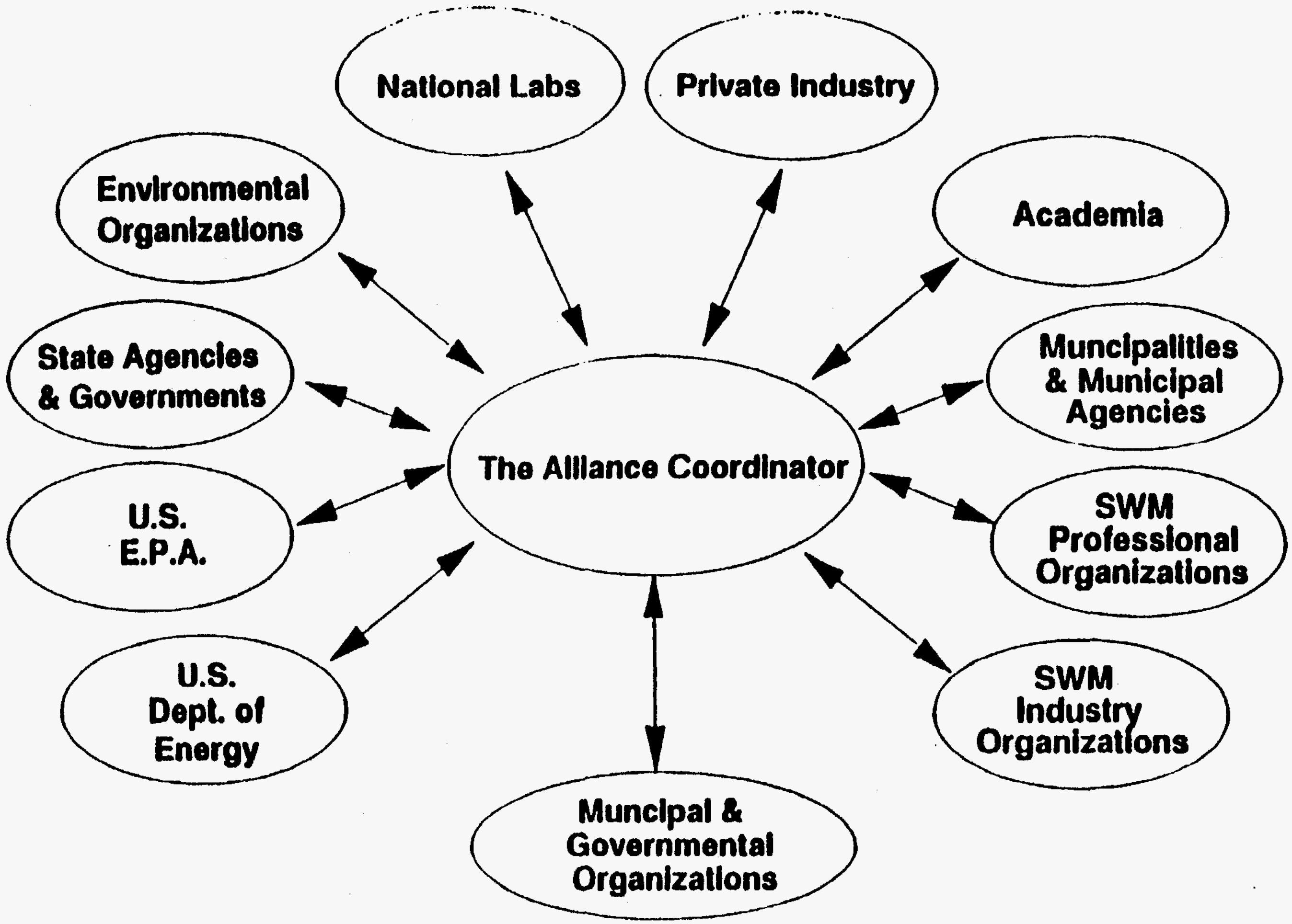

Figure 2 - The Alliance: Function of Elements

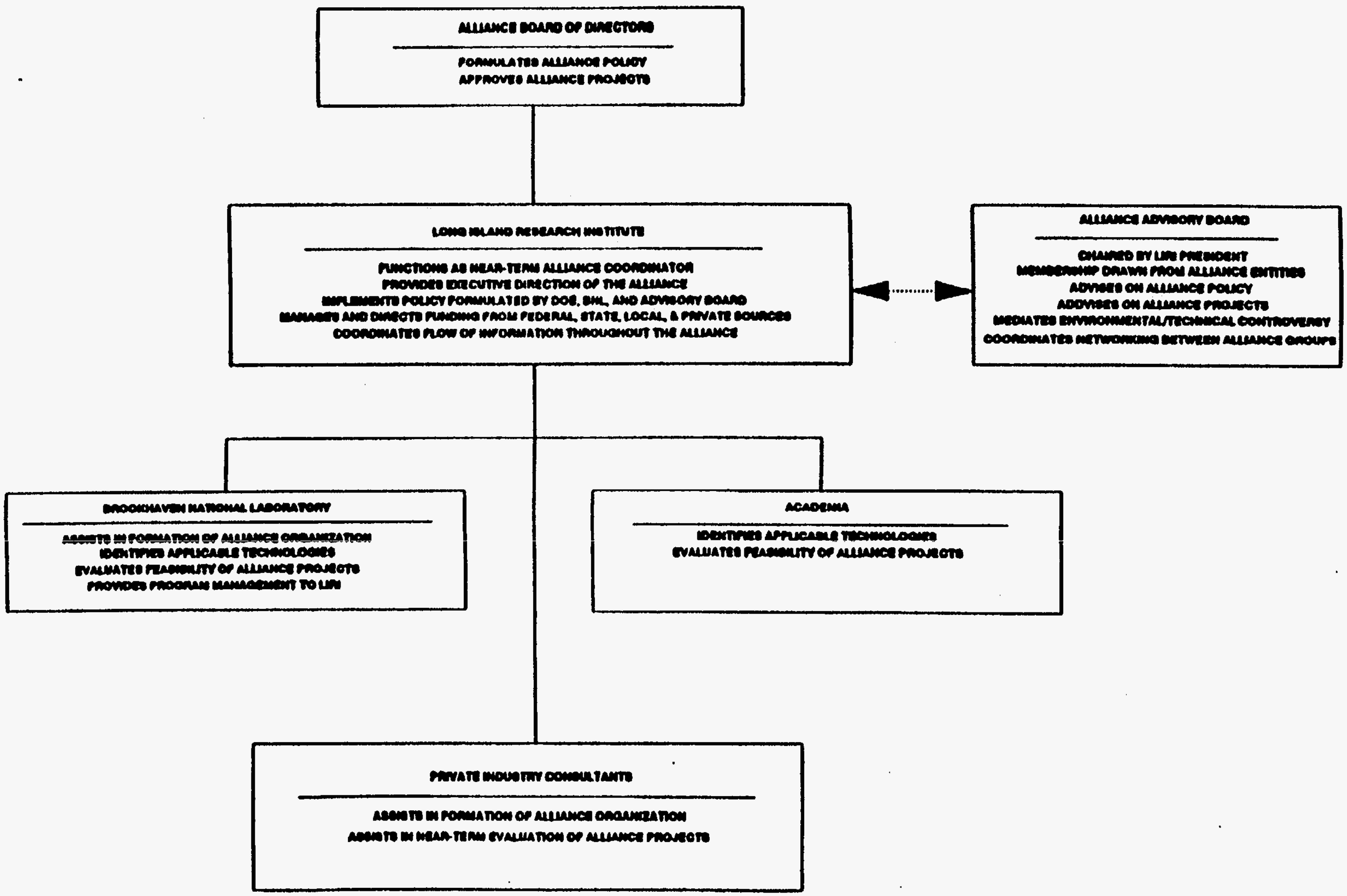

Figure 3 - Alliance Organizational Structure

Attachment 3

NEWME Strategic Plan

LIRI-94-004 BNL-52441

STRATEGIC PLAN

for the

NORTHEAST WASTE MANAGEMENT ENTERPRISE

NOVEMBER 1994

Long Island Research Institute
110 Lake Ave.South - Suite 35
Nesconset, NY 11767

Brookhaven National Laboratory
Associated Universities, Inc.
Upton, NY 11973

neWme
The Northeast Waste Management Enterprise

STRATEGIC PLAN

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Under Contract No. DE-AC-76CH00016 with the
UNITED STATES DEPARTMENT OF ENERGY

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FIGURES and TABLES

1. EXECUTIVE SUMMARY

The Northeast Waste Management Enterprise (NEWME) is a new form of partnership whose goal is to increase the economic, commercial, and environmental effectiveness of solid waste management (SWM) through implementation of new technologies. This goal will be achieved by bringing together expertise and technologies in the federally-supported research community and the private sector to trigger the emergence of a high-tech, highly competitive waste management industry, first locally on Long Island, then nationally as well as internationally. Of particular interest to NEWME are technologies that are applicable to the Northeast's waste management problems and technologies applicable to the Department of Energy's waste management and environmental clean-up programs.

NEWME, which is being managed by the non-profit Long Island Research Institute (LIRI) in collaboration with Brookhaven National Laboratory, has already identified potential technology candidates. These include land reclamation using bioremediation, pyrolysis, waste stabilization/ash utilization, and landfill containment. The next step, which has already begun, is to evaluate specific technologies within these focus areas. This validation and verification process will take place with appropriate academic and commercial partners. We anticipate the need, in some instances, for a demonstration project. A concurrent economic analysis will take place along with each program, which, together with technical evaluations, will form the basis for decisions relating to the ultimate commercialization of the technology.

The financial plan for NEWME anticipates an evolution over time in which the Federal Government provides most of the funding in the early design phase, with some industrial participation. As the program progresses through demonstration and early commercialization, the program becomes more expensive, and a larger fraction of the costs is borne by the private sector. NEWME itself will participate financially in each commercialization vehicle in order to form the basis for the eventual self-sufficiency of the program.

2. CONTEXT

2.1 Waste Management Problem

Perhaps the most important, long-term environmental problem facing the Northeast during the next decades is what to do with the massive amounts of municipal and industrial waste generated daily. With the highest population density in the country, this region consumes more energy and produces more waste than any other, yet is possesses the fewest sites for waste disposal. Approximately 180 million tons of municipal solid waste were produced in the U.S. in 1988. Long Island has the dubious honor of leading the world in per capita solid waste production at 7 1/2 pounds per day. For a variety of economic, environmental, and political reasons, as the amounts of solid waste increase, the number of acceptable disposal options decreases. This has resulted in a large and growing interstate traffic in solid wastes. New York and New Jersey are the most aggressive solid waste exporting states, accounting for more than 50% of the total interstate traffic in solid wastes in 1989. Local flow control laws have recently been invalidated by the Supreme Court, thus increasing the incentives for interstate transport of waste. Trucking waste long distances, however, has high societal costs: it is wasteful of energy and burdensome on the transportation infrastructure. It also fails as a long-term solution, since fewer and fewer sites are available to accept wastes.

Fully integrated resource recovery systems are becoming more attractive as a solution to regional solid waste management, as are environmentally benign manufacturing processes. However, as discussed in a recent seminal monograph, "The options for ultimate disposal -- for that fraction of the municipal [and industrial] solid waste stream that cannot be eliminated through source reduction, reuse, and recycling -- are limited to two: landfilling and incineration."[1]

While the Northeast may be the best region for addressing this problem, the problem of municipal and industrial waste is a rapidly-growing concern in the rest of the country and throughout the world. Thus, competitive, effective solutions arrived at in the Northeast can form the basis of world-wide commercial activities.

One of the most substantial undertakings of the Federal Government is to restore the environmental quality at hundreds of sites involved in its activities and those of its predecessor agencies. Of particular concern are sites historically involved with the production of materials for nuclear weapons. The price tag associated with this vast clean-up effort has been estimated at some $100 billion. Thus technologies that can reduce that cost would be of significant benefit to the nation.

After assessing the prevalence and risks of its various kinds of environmental problems, and the comparative need for technology to address them, DOE has identified five initial remediation and waste management focus areas within its weapons complex: contaminant plume containment and remediation; mixed waste characterization, treatment and disposal; high level waste tank remediation; landfill stabilization; and facility transitioning, decommissioning and final disposition. As we consider technologies to be developed in the NEWME program, an important consideration is their relevance to these DOE focus areas.

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[1] Schubel, J.R., and H.A. Neal, Garbage and Trash, Can we Convert Mountains into Molehills?, Monograph Series of the New Liberal Arts Program, Research Foundation of the State University of New York at Stony Brook (1992).

2.2 Opportunity

The Department of Energy and other federal agencies have invested significant sums over the last three decades in understanding the scientific and technical aspects of environmental contamination. As a result of these programs, there reside in the federal laboratories and academic research institutions a number of promising technologies that, for the most part, have been developed only up to bench-scale demonstration. Bringing those technologies to the point at which they can contribute to the solution of real life environmental problems can only be accomplished through partnerships with industry. The creation of such partnerships is one central objective of NEWME.

In January of 1994, DOE defined a new approach to environmental research and technology development. This plan calls for more industry and academic involvement in developing and implementing solutions to DOE's remediation needs; enhancing regulator and stakeholder involvement; and accelerating DOE - private sector technology transfer in both directions.[2] NEWME constitutes a regional vehicle for implementing this new approach, drawing on relationships and mechanisms already put into place by Long Island Research Institute.

3. HISTORICAL BACKGROUND

In October 1992, in response to a request from the Department of Energy, the National Laboratories formed the Strategic Laboratory Council (SLC) to carry out integrated planning to guide future investments in technological solutions to environmental restoration and waste management problems facing DOE and the Nation. An important SLC recommendation was the establishment of "The Alliance", a new organization to facilitate interaction among DOE Laboratories, industry, and universities. The objective was to create an environment for cooperative development in key technology thrusts and cross-cutting technologies.

During March 8-9, 1993, the Deputy Assistant Secretary of the DOE's Environmental, Restoration and Waste Management Program attended a workshop at Brookhaven National Laboratory (BNL) to discuss the Alliance concept as it pertained to the Northeast. With the previously cited environmental and waste management problems as background, it was decided to bring together the diverse talents now existing in the Northeast to trigger the emergence of a highly competitive waste management industry, first locally, then on a regional basis, and finally nationally and internationally.

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[2] "A New Approach to Environmental Research and Technology Development at the U.S. Dept. of Energy" - Action Plan, Jan. 25, 1994. USDOE, Washington DC.

NEWME was able to achieve a rapid start-up by exploiting existing regional organizational structures. The Long Island Research Institute (LIRI), a non-profit organization created by Long Island's major research institutions to facilitate technology commercialization and cooperative research, was the ideal vehicle to manage the undertaking. LIRI had already established effective working relationships with Brookhaven National Laboratory, the University at Stony Brook, Cold Spring Harbor Laboratory and North Shore University Hospital, its founders, and with industry and the financial community in the region.

NEWME held its first formal meeting on May 7, 1993 at the University at Stony Brook Campus under the sponsorship of LIRI. Attendees included representatives of the solid waste management (SWM) industry, including a firm which is perhaps the preeminent source of information to the SWM industry, as well as the Commissioner of SWM for the Town of Brookhaven (the largest political entity on Long Island, with a population in excess of 400,000). Several key needs of the industry were defined, spanning the gamut of waste stream separation, recycling and reuse, incineration, and landfilling. Several applicable technologies were identified which could serve as initial examples for technical and economic evaluation by NEWME.

The Stony Brook meeting contributed to the development of an initial business plan for NEWME. The draft plan was circulated during the summer of 1993, and Brookhaven received start-up funding for NEWME from DOE in July. Numerous meetings with industry, academic and government representatives were held during the summer and fall. Of particular note were meetings between Brookhaven and RPI to establish a partnership for environmental education and research. In September, Brookhaven, with LIRI co-sponsorship, organized a symposium on problems and commercial opportunities in waste recycling.[3] LIRI and Northeast industry and regional governmental agencies contributed a significant amount of effort to the design of NEWME during the second half of 1993. In April 1994, Brookhaven awarded LIRI a contract.

4. MISSION AND STRATEGY

The mission of NEWME is to contribute to the creation of a technically sophisticated, internationally competitive waste management industry for the United States. The initial foci are the solid waste management problems associated with densely populated areas such as the Northeast U.S., and the waste cleanup problems of the U.S. Department of Energy. To realize that vision, a new form of partnership will

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[3] Goland A. N. and Leon Petrakis, "Recycling Technologies and Market Opportunities," Proceedings of a Conference held at Brookhaven National Laboratory, BNL Report BNL-52421, September 1993.

be formed to combine the expertise and resources of government, the scientific and technical capabilities of the research community, and the technical, financial and entrepreneurial resources of the private sector.

The overall strategy is to identify key environmental problems that can be attacked through the application of technology resident in the research community paired with private industrial capabilities. In some instances, we expect that it will be a matter of upgrading technology already resident in the private sector. In other instances, technology will have to be transferred from federal research institutions into the private sector. The *ab initio* participation of local, state and federal regulatory agencies will facilitate the demonstration and commercialization process and ensure that technologies conform with existing regulations. While the process will be catalyzed by the Federal Government, with DOE taking the lead, private industry and private capital will drive the commercialization process. The central criteria that are being used to evaluate technologies for NEWME are commercial, such as the size of the market and economic competitiveness.

5. ORGANIZATION

5.1 Participants

Each of the participants in NEWME will perform a well defined set of functions. As the coordinating organization, LIRI will provide management and guidance from the pre-competitive stages of a project through its early commercial development. Brookhaven National Laboratory will be responsible for technical aspects of NEWME and for coordination with other federal laboratories. Various participants will work together at different times in this process. Some participants will be involved at the continuing, programmatic, level; others will participate in technology-specific projects. At both levels, there will be participants from the research community and from private industry. Other participants will come from waste management professional organizations, and environmental groups.

5.2 Responsibilities

The role of NEWME Manager is a natural one for the Long Island Research Institute. LIRI was created by Brookhaven National Laboratory, the State University of New York at Stony Brook and Cold Spring Harbor Laboratory (later joined by North Shore University Hospital) as a non-profit entity specifically to commercialize technologies from research laboratories and to foster productive interactions between research institutions and industry. LIRI's Board of Directors and its Scientific and Business Advisory Council already include senior representatives of the region's technical, industrial, and financial communities. Furthermore, LIRI's senior staff have extensive experience in managing large scale multi-disciplinary technical projects.

Brookhaven National Laboratory plays a number of key roles in NEWME: as a source of technologies and technical support, a point of coordination with other federal laboratories, and an evaluator of technologies. Brookhaven is one of the nation's strongest and most diversified R & D laboratories. The Environmental and Waste Management Center in BNL's Department of Advanced Technology has recognized expertise in areas related to mixed wastes, including materials development for containment, encapsulation, and in-situ establishment of barriers. These researchers have also developed new technologies for monitoring groundwater and air pollution. Researchers in BNL's Department of Applied Science have developed ultra-low concentration perfluorocarbon tracers, and are investigating the role of naturally occurring microbes in waste degradation and transformation, and advanced materials development for landfill containment and corrosion resistance.

Brookhaven's major facilities are invaluable tools in support of industry. Its National Synchrotron Light Source, one of the world's most intense x-ray source, currently supports more than 70 industrial users. BNL encourages Cooperative Research and Development Agreements (CRADAs) with industry, as do other federal laboratories. Each CRADA represents a cooperative program between personnel at the laboratory and those from the private sector. It is anticipated that some field demonstrations of NEWME technologies will be funded through the CRADA mechanism.

As part of its role in NEWME, Brookhaven will access technologies under development at other federal laboratories through existing databases, through DOE channels, and through established direct relationships.

Involvement of various academic institutions will provide additional technical and analytical expertise to NEWME. The University at Stony Brook's Waste Management Institute has a variety of research and educational programs aimed at reducing the impact of waste generation and disposal on society. An ongoing research program studies the use of incinerator ash for construction materials. Its staff have collaborated with BNL scientists in areas related to bioremediation and materials development. For NEWME, they recently completed an evaluation of pyrolysis technologies.

Among the northeastern universities that are expected to play roles in NEWME are Rensselear Polytechnic Institute (RPI), with which BNL has a cooperative program to address waste technology research and education; Polytechnic University (Department of Civil and Environmental Engineering), with which BNL has designed cooperative educational programs; MIT (Center for Nuclear Chemical Technology in the Department of Nuclear Engineering); and the Waste Management Institute at Cornell University's Center for the Environment.

As discussed below, the structure of NEWME is expected to evolve over time. However, the initial functions of the major participants are as follows:

NEWME Advisory Board

- Advise on NEWME policies and priorities
- Advise on industrial participants
- Advise on financial and intellectual property issues
- Facilitate high level industry and government participation
- Facilitate interaction between NEWME participants

Long Island Research Institute - NEWME Coordinator

- Overall management and coordination
- Designate and supervise Project Managers of individual NEWME projects
- Evaluate business/financial aspects of projects
- Structure cost sharing and private sector involvement in projects and commercial undertakings
- Encourage participation by state and regional agencies

Brookhaven National Laboratory

- Manage DOE financial participation
- Coordinate participation of other federal laboratories
- Evaluate potential technologies for NEWME projects
- Develop data bases for NEWME and related DOE projects
- Conduct research in support of NEWME projects, in coordination with other federal laboratories and universities
- Supply facilities for project demonstration
- Conduct environmental technology training programs with academic collaborators
- Conduct risk assessments

U.S. Department of Energy

- Provide funding for NEWME start-up
- Provide near-term co-funding of individual NEWME projects
- Facilitate interaction with DOE programs
- Create favorable climate for NEWME in other federal agencies
- Coordinate participation of other federal agencies in NEWME projects
- Provide information on technologies and research programs
- Provide information on DOE environmental restoration and waste management needs

Additional organizations will serve as resources that can provide important support services as follows:

U.S. EPA
- Provide guidance on critical environmental issues and regulations
- Provide co-funding of research activities related to impact of technologies
- Advise on regulatory barriers to acceptance of technologies
- Work with state and local agencies to resolve regulatory anomalies

Other Federal Agencies
- Provide guidance on agency programs and needs
- Provide co-funding of agency-relevant projects

N.Y. State Department of Environmental Conservation
- Advise on regulatory requirements for development and demonstration projects
- Advise on issues related to acceptance of commercial technologies
- Advise on potential sites for demonstrations
- Facilitate permitting of demonstrations, etc.

Other State Agencies
- Identify high priority SWM issues
- Represent economic development interests of states
- Provide co-funding of projects

Private Industry
- Propose new ideas/technologies to NEWME
- Participate in project design and demonstration, with in-kind services
- Commercialize technologies

Academia
- Provide research and general academic expertise
- Coordinate education and retraining within NEWME objectives
- Participate in technology evaluations
- Provide general peer review

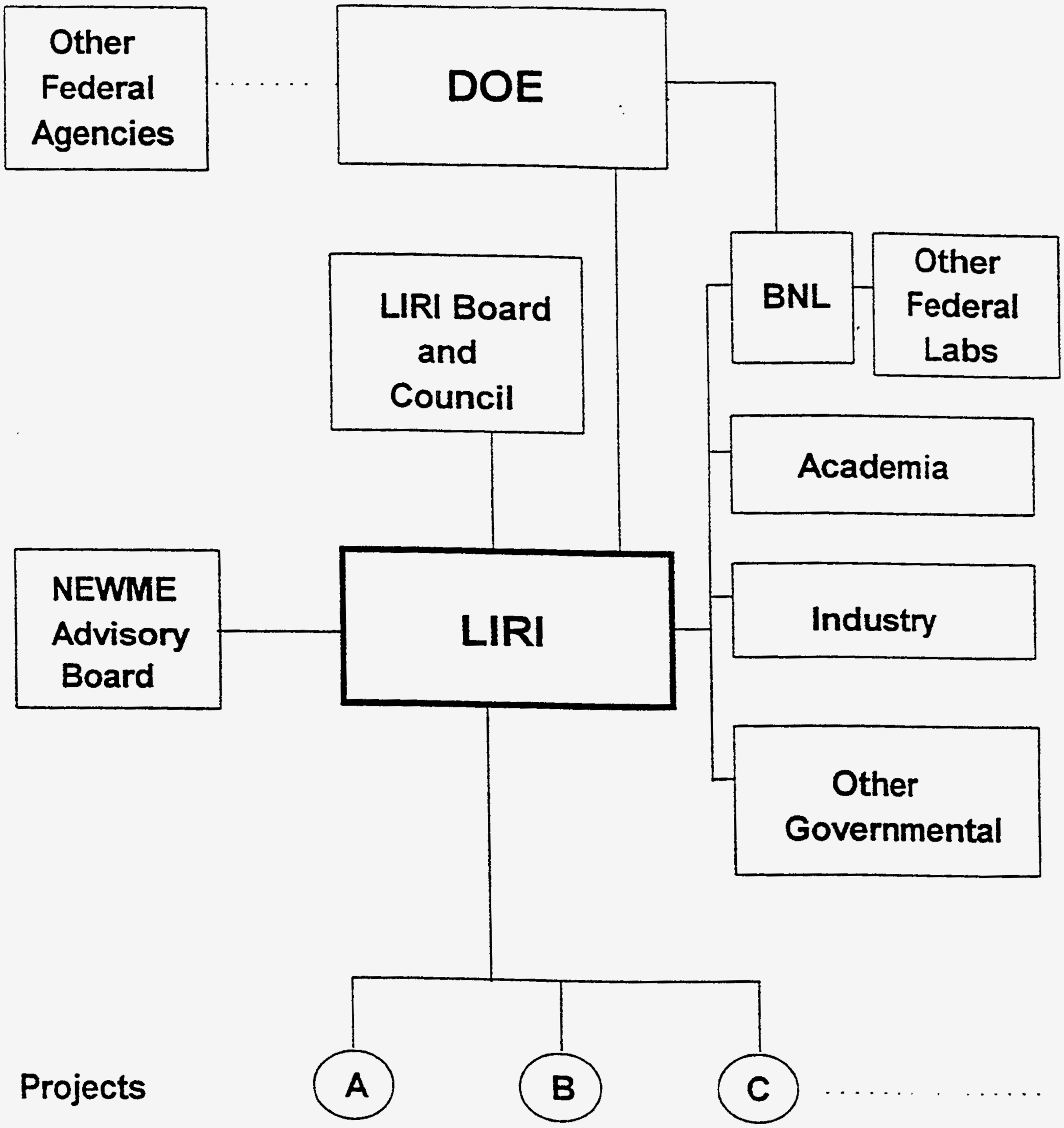
In performing technology, siting, and risk assessments, NEWME will seek input from environmental organizations and appropriate municipal agencies; several of these are identified in Appendix A. Solid waste management organizations will assist in identifying consultants, review technology evaluation, and provide guidance for needed research.

5.3 NEWME Organization

NEWME brings both new technical resources and a new organizational approach to the solid waste management problem. The organizational structure designed for NEWME is intended to bring together effectively all of the elements required to meet the program's objectives and to overcome critical institutional and technical barriers. Figure 1 shows the initial NEWME structure. In the first phase of NEWME's development, the principal activity is a centralized one: the identification of critical technologies and the structuring of projects to advance each technology to the point preceding commercialization.

FIGURE 1

INITIAL NEWME STRUCTURE



The NEWME structure will evolve over time with the individual projects taking on greater and greater significance. Figure 2 shows, in simplified form, how that structure is expected to evolve. In the second phase, each project will have an appropriate set of working relations. A typical project may take the form of a technology demonstration involving several participants, for example, one or more companies, a research institution, DOE and NEWME itself. At this stage, it may or may not be appropriate to create a separate corporation to carry out the demonstration and commercialize the technology.

In Phase III, initial commercialization, a private entity, referred to in Figure 2 as Company A, will lead the commercialization effort. In most instances we would expect that entity to be selected in Phase II and to be a pre-existing company. Conceivably, a new company or joint venture could be formed in Phase II or III to implement the technology. As shown in the figure, private (venture) capital may be required in some instances to finance the implementing company. Even at this stage, it is quite possible that a relationship with a federal laboratory or a research university will still be useful. Under appropriate cooperative agreements, those institutions could serve as the R&D "department" of the implementing company. The meaning of "NEWME Inc" in Phase III will be made clear in the following discussion of financing.

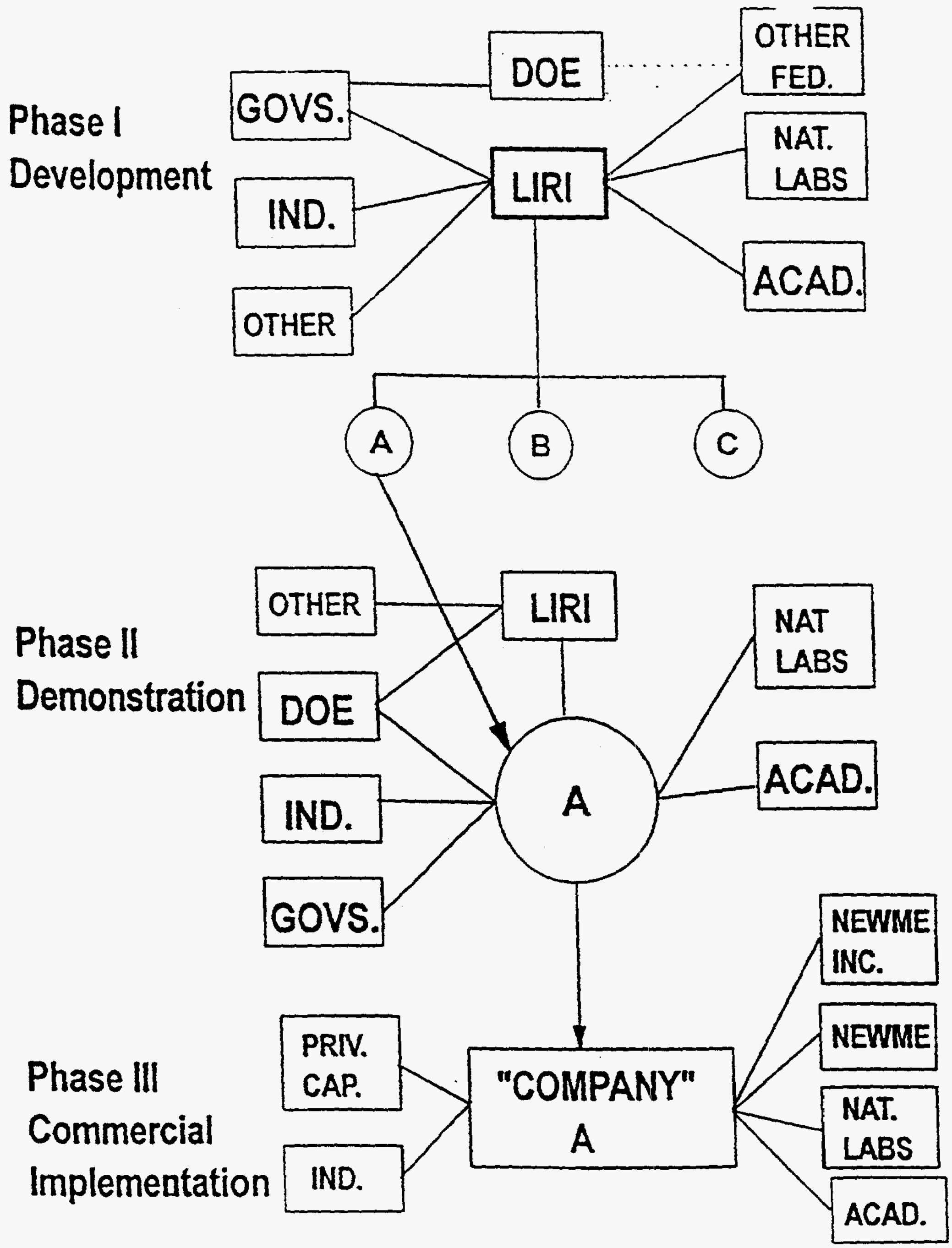
6. FINANCIAL STRUCTURE

From its inception, a central tenet of NEWME has been that federal monies would be leveraged by the use of other funds. This is not simply a means of maximizing the return on federal investment. Rather, it reflects the basic concept of the activity as being a partnership between government and industry. If that kind of partnership is to succeed, the industrial partner must be sufficiently interested to commit resources to the effort. The ultimate objective is for the technology to be commercially viable on its own merits. In this situation, excessive federal funding can mask the commercial realities.

Nonetheless, federal involvement is critically important. A central thrust of the DOE's program is to maximize the benefits to the U.S. economy from the Department's investment in environmental restoration and waste management. Federal participation is required to overcome the significant barriers to commercialization of technologies and skills resident in the National Laboratory system. For example, many technologies of interest have been proven only on a small scale within the laboratories, and the risks of larger scale demonstration are too high to attract private capital.

FIGURE 2

PROJECT STRUCTURE EVOLUTION



Thus a central design problem in NEWME was to craft an appropriately shifting balance of funding between federal and private sources over the commercialization process. Beyond individual projects, it would be desirable for the overall process eventually to become self-sufficient.

6.1 Program and Project Finance in NEWME

We should emphasize that the amounts and the balance between various sources of funds in the NEWME project will depend greatly on the nature of the specific technologies with which we are dealing, and the specific steps required to make them commercial. In this discussion we use an individual technology as the basis for discussion, realizing, however, that there will be a sequence of technologies in the program. As the program matures (and assuming the demonstrated success of the process), at any one time there may be several technologies in each project phase.

Earlier, we identified several categories of participants and their roles in the process. For this discussion we group them into the following categories:

1. **Federal Government**. This is primarily DOE, but funding may also come, for example, from EPA or DOD. The participation of the National Laboratories and universities is central, and their participation will be funded in the early stages by the government. While the most evident financing by the government will be in cash, the expertise provided by government agencies, as well as the risk-reduction inherent in government involvement will be important contributions.

2. **Industry**. Industry will carry an increasing fraction of an increasing financial burden over time.

3. **Private Capital**. In some circumstances, private venture capital, as distinct from the pre-existing resources of the industrial participants, may be important. If the industrial participant is a relatively small company, but otherwise uniquely qualified to commercialize a technology, venture capital may be required to fund a demonstration or technology transfer. If the industrial partner is large and well capitalized, there may be no need for additional private capital.

4. **Other**. Depending on the technology, an important "other" could be state government. In fact, New York State , through LIRI, has already been a significant contributor to the development of the NEWME plan. As described below, we view NEWME itself as another source of financing over the long term.

Let us now look at the role of the various sources of financing during the various phases of a NEWME project.

Planning and Development

The planning and development phase, in which the overall program is designed, technologies are evaluated, and participating companies are selected, involves the largest element of risk and uncertainty. Furthermore, the value created during this phase of the program can not be captured by specific companies (indeed it would be inconsistent with DOE policy and the public interest for that "capture " to occur). Thus, this phase must be primarily supported by federal funds. At the same time, the involvement of industry is also necessary. It is also very important for the future success of the overall effort for other federal agencies (e.g. EPA) and state and local agencies to be involved and to "sign on" to the program objectives and to the process. These involvements will constitute significant contributions in kind.

NEWME is now part way through this planning and development phase, and there has already been significant participation of parties other than the Federal Government. New York State has provided significant funding for the early NEWME planning process. LIRI's work in FY 1993, for example, was entirely supported by the State Science and Technology Foundation. State and local government personnel have also participated generously in the planning process to date.

The planning and development phase of NEWME relates both to the overall program, and to specific technologies or projects. Although of obvious fundamental importance, this phase is the least expensive, on the order of $1 million per year.

Demonstration

In the demonstration phase, federal and/or university technology is allied to private industrial capability and critical technical, regulatory and economic issues are resolved. While success in identifying a promising technology now reduces uncertainty, this phase still carries considerable risk. Depending on the particular technology, and the particular issues to be addressed, it can be an expensive phase. However, since the industrial participant is gaining access to technology and possibly other benefits such as a facilitated demonstration process, it will be expected to cover a significant fraction of the cost. One model for designing this phase is the Cooperative Research and Development Agreement (CRADA), described above (p.6).

Depending on the technology and the needs of the industrial partner, private venture capital can start to play a role in this phase. We would anticipate that this phase would involve a roughly equal level of effort between the federal participants on the one hand, and the non-federal on the other. The total cost of this phase might be as much as an order of magnitude greater than the first phase ($5-$10 million).

Early Commercialization

The first commercial installation of a technology may not be financially optimal, and significant technical improvements may still be possible. Construction and operation of the first full scale plant will be the responsibility of the private sector. Private venture capital may play a role, particularly for smaller companies. Sources of loan financing may also begin to be tapped in this phase. Depending on the financial strength of the companies involved, there may be some funding by industry of the national laboratory or university participants, perhaps on a joint basis. It may also be justified for DOE to provide funds for technical support, or to address specific (e.g. environmental) issues or to contract for the initial plants or services. For some technologies the scale of this phase may be another order of magnitude higher than the previous one, conceivably in the $100 million range.

Late Commercialization

With full scale commercial implementation, industry is on its own. Indeed, in the NEWME model there will be a flow of funds back to the other participants. Again depending on the technology, there may be a continuing role of the research community (federal laboratory or university) in improving the technology or in addressing specific technical problems in implementation, funded by industry.

6.2 Leveraging of DOE'S Investment

Table 1 summarizes the trend of financing of the program over time. It should be emphasized that there will be wide variations among technologies and this table is only representative. The first phase includes activities relevant to the overall program, whereas later phases are technology-specific. As indicated in the table, the DOE share decreases from 80% in the relatively inexpensive first phase to 2% in the early commercialization phase, to zero in the final late commercialization phase. The column labeled "Level" gives estimates of the order-of-magnitude funding required for each phase.

The split indicated between private capital and industry in the table will depend on the financial strength of the industrial partner and the particular technology involved. The "Other" participants shown in the table are primarily state and regional government agencies.

The direct implication of the Table is that DOE funds will be leveraged in this program approximately 14:1. If the DOE is able to share its cost with other federal agencies, the leveraging of DOE funds (although not total federal funds) would, of course, be even greater.

TABLE 1

NEWME NOTIONAL FINANCIAL PARTICIPATION

	PHASE	LEVEL $ MILLION	Financial Participation, % DOE, EPA	INDUSTRY	PRIVATE CAPITAL
I	Planning & Development	1	80	20[a]	
II	Demonstration	10	50	40[b]	10
III	Early Commercialization	100	5[c]	30	65[d]

Notes:

[a]In-kind participation

[b]In-kind and financial

[c]Related research support

[d]Dependent on industrial financial capability

6.3 Overall Cost-Benefit

The pattern of cooperative funding laid out in this section has been designed to accomplish the objectives of the program with the most economical and effective use of federal funds.

What is the anticipated return on this federal expenditure? One can distinguish two categories of benefit: benefit to DOE itself, and national benefit. At least some of the technologies commercialized in this program will have direct applicability to DOE's cleanup efforts. Even a very small percentage reduction in the cost of that effort will outweigh by orders of magnitude the cost to the government of this program. Some national benefit will also result from a reduction in the cost of remediation and waste management. The national economy will also benefit from the creation of a more globally competitive U.S waste management industry, which will increase jobs and tax revenues and improve the balance of payments.

6.4 Towards Self-Sufficiency

NEWME is designed to become self-sufficient over time, with federal funding replaced by internal resources. A corporate entity, possibly non-profit, will be created for this purpose. In the organization chart shown above in Figure 2, that entity is referred to as NEWME, Inc. As technologies are licensed to companies, or financing is arranged, NEWME, Inc. will participate in the royalty stream or in the equity of a newly financed company. As finances build up in NEWME, Inc., they will be used to replace the funding provided in early stages by DOE. Thus, from an overall perspective, the original DOE funding will be used to prime the pump of the program. The private sector will provide the lion's share of the funding, and the process will become self-supporting.

This is a very ambitious aim. Because it is unprecedented, and given the vagaries of commerce, it cannot be guaranteed. But NEWME is committed to it as an integral part of its design.

7. NEWME WORK PLAN

While this is not the appropriate context for a detailed work plan, we summarize here the major steps already taken and to be taken in that plan.

7.1 Program Focus

As discussed above, there are two domains of environmental problems that are addressed through NEWME projects: the solid waste management problems of the Northeast, and DOE's environmental cleanup problems. Ideally, we seek technologies that apply to both domains.

7.2 Project Identification

The first step in identifying the initial technologies for NEWME was to establish a set of relevant criteria. These criteria were:

- the problem to be addressed by the technology is significant, and perceived as such by major participants (public, government, scientific, community, etc);
- there is the potential for major impact by the application of new science or technology;
- a NEWME undertaking (e.g., a demonstration project) can make a difference and is practical;
- the application is economically and commercially attractive (i.e., there is a large market for the targeted product as revised);
- the technology has relevance to DOE's environmental management and clean-up problems.

After screening by these criteria, the following four technological areas have been selected for initial NEWME consideration:

Pyrolysis

Although the region's waste management strategy already includes a significant investment in incineration, the recent Supreme Court ruling on ash characterization is likely to hinder further use of this waste treatment technology, and adversely affect the economics of existing plants. Pyrolysis, which is a reductive heating process producing a high-carbon char and relatively clean gas stream, represents a desirable alternative to incineration for the treatment of municipal solid waste and hazardous waste streams. Conjoined with technologies that address radioactive contaminants, pyrolysis has wide applicability in treating mixed wastes.

Pyrolysis yields two product streams which have existing commercial markets. The char can be used as is to replace carbon black, or upgraded for use as activated carbon for adsorption of VOCs and other contaminants. The hydrocarbon gas stream can be burned to power a steam power generation system, or condensed to liquids that can be used as plastics feedstocks or liquid fuels. Engineering difficulties that prevented full commercialization of this technology when it was studied in the 1970's appear to have been overcome, and its applicability to both MSW and DOE remediation needs make it an attractive candidate for commercialization via NEWME.

A thorough technology review, describing the relative strengths of four mature commercial pyrolysis technologies, was completed in March of 1994. This report includes recommendations for the next steps to be taken in development and commercialization of pyrolysis.

Bioremediation/Land Reclamation

Reclamation of contaminated land represents an attractive alternative to "greenfield" development because of public pressure to limit the development of wild land, and because previously used sites are served by an existing infrastructure. Bioremediation, especially when carried out in situ, represents an attractive alternative to excavation-based remediation strategies. Considerable progress has been made in isolating a variety of contaminant degrading organisms; NEWME's goal is to facilitate the engineering development needed to employ them in bioremediation-based application and treatment systems. Bioremediation has cross-cutting applicability to DOE's contaminant plume remediation, facility decommissioning, and mixed waste treatment needs.

NEWME has initiated efforts to explore the addition of PCB-degrading cultures isolated at BNL to the bulk solids handling capacity of existing MSW-composting technology. In this bioenhanced composting concept, the goal would be to reclaim a contaminated parcel of land and return it to public or commercial use. NEWME has begun a literature review to assess the extent of work in this area, and is identifying candidate sites for a demonstration of this technology.

A BNL-developed bioremediation process for the degradation of radionuclides and heavy metals is being explored as an option to treat uranium-contaminated soils at a DOE site in Ohio. This process has been successful in removing uranium contamination in bench-scale tests, but has not reached pilot scale. NEWME is working with Parsons Engineering to explore the feasibility of this process for the site in question, and to identify the development requirements for commercialization of this technology.

Waste Stabilization/Ash Utilization

<u>Incinerator Ash Recycling:</u> The use of incineration to dispose of MSW is limited by its production of hazardous substances in atmospheric emissions (e.g., dioxins)

and fly ash (e.g., heavy metals). It is generally agreed that constituents in bottom ash are of less concern. A recent Supreme Court ruling[4] that MSW incinerator ash must be categorized and treated as hazardous waste if it does not pass EPA leachate (i.e., TCLP) tests has reinforced public objection to incineration. Nevertheless, a recent study comparing the full spectrum of environmental and health effects from incineration, landfills, pyrolysis, and waste-to-energy-facilities has found that well managed incinerators have the least negative impacts.[5]

Various process improvements (as well as new technologies such as afterburners) have mitigated concerns about atmospheric emissions from incinerators. Numerous attempts have been made to encapsulate incinerator ash, primarily bottom ash, in materials such as concrete and Portland cement. These materials are then used beneficially, such as in road aggregates and offshore reefs. Thus far fly ash as proven more recalcitrant, the few successful encapsulation technologies having failed EPA's leachate tests. Recently, however, Brookhaven researchers, employing materials and techniques developed to assist DOE in handling radioactive wastes, have encapsulated fly ash using sulfur and polyethylene cements.[6]

The Town of Brookhaven (ToB) has expressed interest in building a roadbed at its municipal landfill using aggregates from BNL's encapsulation technologies, if it can be demonstrated that such materials can be fashioned from bottom and fly ash produced from ToB MSW. NEWME has provided seed funds to BNL to demonstrate the feasibility of using sulfur and polyethylene cements to encapsulate ToB ash, and will move ahead with the ToB and academia (e.g., the Waste Management Institute at SUNY/Stony Brook) to establish a demonstration of BNL and other candidate technologies at the ToB landfill site.

Landfill Containment

Until recently the most common approaches to minimizing landfill leachate production and migration have been to cap the site (thereby preventing infiltration and subsequent leaching) and to construct systems to collect actual leachate. Capping

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[4] City of Chicago v. Environmental Defense Fund, No. 92-1639, Supreme Court of the United States, decided May 2, 1994.

[5] Hahn, J. L. and K. H. Jones, "Waste-to-Energy: The Next Step in the Hierarchy After the 3-Rs," Ogden Martin Company, Proceeding of the 1994 Waste Processing Conference (16th Biennial National Conference) and the North American Waste-to-Energy Conference, The American Society of Mechanical Engineers, Boston, MA., 1994.

[6] Kalb, P. D. and T. Lee, "Thermoplastic Polymer Treatment of Municipal Solid Waste Incinerator Ash: Preliminary Treatability Study Letter Report," BNL draft letter report, March 1994.

puts an end to any further useful operations of the landfill. Leachate collection systems are not very effective unless they are part of the original landfill design process, where they are engineered to work together with double or triple liners.

Recognizing the ubiquitous presence of leachate plumes at landfills, it is important to demonstrate other methods of managing these plumes. Examples of such techniques include pump-and-treat, pumping to effect massive hydrogeological changes in the vicinity of the site, the use of selected waste products to assist in reclaiming landfill sites,[7] and emplacement of in-situ barriers.

NEWME has investigated several in-situ barrier technologies, including a system developed at BNL with funding from DOE's Office of Environmental Management (EM).[8] An inexpensive, easily emplaced (i.e., injected) subsurface barrier would represent a major step toward containment of plumes at all sites of such contamination. As in the case of incinerator ash recycling, the Town of Brookhaven has expressed interest in the demonstration of in-situ barriers at its municipal landfill. Such a demonstration would also be possible at BNL.

7.3 Technology Evaluation and Commercialization Plan

The next step to be carried out in each technological focus area is to evaluate specific commercial embodiments of the technology or commercializable versions of the technology if there is no commercial embodiment. The main components of that technology evaluation are:

A. Issues and Objectives

Identification of the specific problem or problems to be addressed by the technology. To what extent is this a problem regionally, nationally, internat-ionally and at DOE sites? What justifies the application of federal (or joint federal-commercial) funds to this problem? How does this address the needs of EM's focus areas?

B. Status of the Technology

What is the status of the technology, including competing versions of the technology? At what level has it been researched, demonstrated, or sold

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[7] Chesner, W. H. and J. P. Welsh, "The Use of Selected Waste Products for Reclamation of Existing MSW Landfill Sites," Proceedings of the National Waste Processing Conference, The American Society of Mechanical Engineers, Book No. 100328, 1992.

[8] Heiser, J., "Polymer Containment Barriers of Underground Storage Tanks," presented at Waste Management '94, Tucson, AZ (Feb 27 - Mar 3, 1994).

commercially? Who are the major corporate actors? (Consideration will be given to overseas as well as U.S. R&D programs and commercialization efforts.)

What are the outstanding technical issues or problems associated with the technology? This discussion should, in particular, identify technical barriers that could be overcome through NEWME projects. Are there potential applications for the technology other than the one envisioned here?

C. Regulatory and Other Issues

This section will identify the non-technical issues that will affect the implementation of the technology. The relevant regulatory environment will be described regionally (e.g., by state) and nationally, both as it exists currently and as it is expected to evolve. There may be positive as well as negative regulatory implications. Other issues might include public perceptions or public opposition (e.g., to facility siting). There may also be liability or other legal issues.

D. The Market

What is the current and expected size of the market for this technology? In order to answer this question one should identify the competitors to the technology and, if relevant, competing versions of the technology. What are the pricing requirements or considerations? Overseas as well as U.S. markets should be assessed. Potential sales of the technology should be calculated on the basis of total market size and the estimated fraction of the market captured by the technology as a function of time.

The Technology Evaluation will form the basis for a decision whether or not to move ahead with a demonstration or other step towards commercial implementation. If it is decided to move ahead, an Action/Work Plan will be formulated to guide the next steps. A typical action plan will involve a specification of the participants, steps to be taken, time schedule, milestones and budget. The plan will state the rationale for the recommendation of the participating company or companies, recognizing that in some instances a competitive selection process will be required. The plan will also justify any recommendation of a specific demonstration site. A proposed budget will indicate suggested cost-sharing and financing arrangements.

APPENDIX A

Professional Organizations

The Air & Waste Management Association
The American Public Works Association
The American Society of Mechanical Engineers' Solid Waste Processing Division
The Association of State and Territorial Solid Waste Management Officials
The Solid Waste Association of North America

Industry Organizations

The American Paper Institute
The American Plastics Council
The Council on Plastics and Packaging in the Environment
The Glass Packaging Institute
The Institute of Clean Air Companies
The Institute of Scrap Recycling Industries
The Integrated Waste Services Association
The National Solid Wastes Management Association

Municipal and Government Organizations

The American Legislative Exchange Council
The Coalition of Northeastern Governors
The International City/County Management Association
The National League of Cities
The National Association of Counties
The U.S. Conference of Mayors (sponsors the Municipal Waste Management Association)
The National Conference of State Legislatures' Solid Waste Management Project
The National Governors' Association (sponsors the Committee on Natural Resources which focuses on SWM issues)

Environmental Organizations

The Sierra Club
The United States Public Interest Research Group
The Environmental Defense Fund
The Natural Resources Defense Council
The Audubon Society

The Northeast Waste Management Enterprise (NEWME) is a new form of partnership whose goal is to increase the economic, commercial, and environmental effectiveness of the waste management industries through implementation of new technologies. This partnership is funded by the Department of Energy and managed collaboratively by the non-profit Long Island Research Institute (LIRI) and the Brookhaven National Laboratory (BNL). NEWME brings together expertise and technologies from the federally supported research community and technical, management, and financial capabilities of the private sector. Of particular interest to NEWME are technologies relevant to both the Northeast's waste management problems and the Department of Energy's waste management and environmental clean-up programs.

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Department of Advanced Technology
Environmental & Waste Technology Center

October 3, 1995

Mr. Steve Webster
U.S. Department of Energy
Chicago Operations Office
Building 201
9800 South Cass Avenue
Argonne, IL 60439

Dear Steve:

Enclosed please find a copy and a diskette of the following TTPs:

1. No. CH36-LF-23, "In-Situ Stabilization of TRU/Mixed Waste,"
2. No. CH36-LF-52, "Stabilization/Containment Systems," and
3. No. CH36-T1-21, "Northeast Waste Management Enterprise."

The first two have been reviewed by the Landfill Focus Area, their comments have been addressed in this version of the TTP, and the TTPs have been placed also on the Germantown server.

Sincerely,

Eena-Mai Franz

Eena-Mai Franz, TPM

EMF/gw
cc: M.S. Davis
~~A. Goland~~
J. Heiser
E. Kaplan

Office of Technology Development 09/28/95
16:17:59

TTP
Summary
Title: NORTHEAST WASTE MANAGEMENT ENTERPRISE
Product Line: TI12 - DOMESTIC - TECHNOLOGY AVAILABILITY

TTP No.: CH3-6-T1-21
Revision: 00
Date: 09/28/95

Subtask No.: 00
Contractor: BROOKHAVEN NATIONAL LABORATORY
HQ Office: TT
Fiscal Year: 1996

Headquarters Focus Area Team Lead: DAVID BERG, EM-521 , 301-903-5135

Partner Focus Area Team Lead: ,

Headquarters Financial Officer: BARBARA WATSON, EM-131 , 301-903-7950

Technical Program Officer: STEVE WEBSTER, DOE-CH , 708-252-2822

Principal Investigator: A. GOLAND/E. KAPLAN , 516-282-3819

Joint Participants: Long Island Research Institute (LIRI)

Jointly Funded Program: PROJECT FUNDED BY EM-50 ONLY

Primary Technology Area: To Be Determined

Secondary Technology Area(s): None

Primary Focus Area: TECHNOLOGY INTEGRATION

Secondary Focus Area(s): None

B&R Code: EW404020 Joint B&R Code:

Auxiliary Fields: 1. EWTC 2. 3.

Task/Subtask Summary:
Old TTP CH333501 :

NEWME's objective is the provision of services and formation of partnerships between industry, federal laboratories, academia, and other institutions in order to accelerate the commercialization of technologies related non-DOE remediation markets. The Long Island Research Institute (LIRI) and Brookhaven National Laboratory (BNL) have developed a Strategic Plan for NEWME which outlines how regional resources can be harnessed to optimize the solution of environmental problems that relate to both DOE and non-DOE site remediations.

NEWME will evaluate, from the perspective of commercial availability, technologies already identified as potentially meeting Focus Area needs. This process will include an evaluation of technical competitiveness and economic feasibility. NEWME will assemble teams of federal laboratory and commercial participants in order to further commercialization. This would include the identification and development of additional sources of capital, and additional markets for advanced environmental technologies to assure their availability to DOE. NEWME draws on the pre-existing expertise of the Long Island Research Institute in finding commercial partners, assessing technologies, and markets, and finding sources of private capital for business that are commercializing EM-related technologies. In addition, NEWME will continue to evaluate the technologies covered in the agreements signed at Moscow 94. The system that is in place assures objective, unbiased analysis of technologies, as evidenced by recent NEWME activities:

NEWME is evaluating technologies from the Former Soviet Union under the aegis of the Moscow 94 Conference.

A the request of the National Center of Manufacturing Science NEWME is designing a collaborative program to address the recycling of plastics from durable goods. Industrial participants include, Ford, General Motors, DuPont, DOW, AT&T, and Eastman.

With $1 M in FY96 ($750K from EM-50, and the balance from other federal agencies, industry, or private sources of financing) NEWME will:

Task 1: ($300K)

1) Assist in the development of commercialization plans for Focus Area relevant technologies, including:

- justification of the choice of the technology
- analysis of technological competitiveness
- analysis of DOE and non-DOE markets
- identification of commercialization partners
- economic and financial analysis and plan

Task 2: ($100K)

2) Perform other technology evaluations as identified by DOE.

A coordinated technology availability program involving many partners is under development. The program will include this activity. Tasks described in this document may be modified to integrate the activities of the several partners, and other specific tasks may be added.

Budget Summary (Dollars in Thousands):
B&R Code: EW404020

	TOTAL ACT TO DATE	1995 ACT	1995-CO	1996 R	1996 FUNDING TO DATE
OE	350	300	0	400	0
CE	0	0	0	0	0
GPP	0	0	0	0	0
LI	0	0	0	0	0
TOTAL	350	300	0	400	0
FTEs				0.00	

	1997 R	1998 R	1999 R	2000 R	2001 R	ALLSUBS YEARS	TOTAL
OE	0	0	0	0	0	0	1050
CE	0	0	0	0	0	0	0
GPP	0	0	0	0	0	0	0
LI	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1050
FTEs	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Budget Summary Totals (Dollars in Thousands):

	TOTAL ACT TO DATE	1995 ACT	1995-CO	1996 R	1996 FUNDING TO DATE
OE	350	300	0	400	0
CE	0	0	0	0	0
GPP	0	0	0	0	0
LI	0	0	0	0	0
TOTAL	350	300	0	400	0
FTEs				0.00	

	1997 R	1998 R	1999 R	2000 R	2001 R	ALLSUBS YEARS	TOTAL
OE	0	0	0	0	0	0	1050
CE	0	0	0	0	0	0	0
GPP	0	0	0	0	0	0	0
LI	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1050
FTEs	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level:
1	FORMAL TTP SUBMITTAL	09/30/95	HQ

Description:

Please submit a formal TTP to Headquarters no later than 30 days after receipt of guidance and funding.

Task/Milestone Summary: Milestone Number:	Milestone Title.:	Due Date:	Level
2	LIST OF CANDIDATE LANDFILL TECHNOLOGIES FINALIZED Description:	11/30/95	CNTR
3	NON-DOE MARKET SURVEY COMPLETED Description:	12/31/95	CNTR
4	ALL TECHNOLOGIES WITH COMMERCIAL POTENTIAL SELECTED. Description:	08/31/96	CNTR
5	FINAL SELECTION OF TECHNOLOGIES FOR COMMERCIALIZATION COMPLETED. Description:	08/31/96	CNTR
6	COMPLETE COMMERCIALIZATION PLANS. Description:	09/30/97	CNTR
7	ONE OR MORE COMMERCIALIZATION TECHNOLOGIES MADE AVAILABLE TO DOE Description:	09/30/97	CNTR

Drivers:

Waste Types:

HLW	TRU	TRU MIX	LLW	LLWM	HAZ	SANT	GTCC
N	N	N	Y	Y	Y	N	N

Full Report Part 2
TTP No.: CH3-6-T1-21   Subtask No: 00
Revision: 00
Headquarters Comments:

Other POCs:

OO Program Manager:		Phone: - -
ID Coordinator:		Phone: - -
IP Coordinator:		Phone: - -
HQ FA Team Lead:	DAVID BERG, EM-521	Phone: 301-903-5135
Partner FA Team Lead:		Phone: - -
HQ Financial Officer:	BARBARA WATSON, EM-131	Phone: 301-903-7950
Tech. Prog. Officer:	STEVE WEBSTER, DOE-CH	Phone: 708-252-2822
Prin. Investigator:	A. GOLAND/E. KAPLAN	Phone: 516-282-3819

Office of Technology Development

Budget Expense Schedule by Cost Element

TTP Title: NORTHEAST WASTE MANAGEMENT ENTERPRISE
TTP No: CH36T121 Subtask No: 00
Revision: 00
B&R No: EW404020
Date: 10/03/95

TPO: STEVE WEBSTER, DOE-CH
TPM:
Principal Investigator: A. GOLAND/E. KAPLAN
Prepared By:

Cost Element(1)	$PYs(2)	FY 1996		FY 1997		FY 1998		FY 1999		FY 2000		FY 2001	
	$K	$K	FTE	$K	FTE	$K	FTE	$K	FTE	$K	FTE	$K	FTE
Direct Labor	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Travel	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Rent, Communications & Utilities	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Printing and Reproduction	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Other Service	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subcontracts	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Supplies and Materials	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Subtotal, ODCs	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total Direct Costs	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Overhead(Indirect Costs)	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Contingency	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total Operating Costs (BO)	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
<Less: Beginning Uncosted>	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Plus: Prefinancing	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Plus: Commitments	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Operating Funds (BA)	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Capital Equipment Funds	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total TTP Funding (BA)	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

1. Minimum Required Elements. Others may be used as necessary from the FIS Object Classification Codes in DOE 2200.10.
2. Prior Years Cumulative actual costs.

Office of Technology Development 10/03/9
14:12:1

TTP
Summary
Title: NORTHEAST WASTE MANAGEMENT ENTERPRISE
Product Line: TI12 - DOMESTIC - TECHNOLOGY AVAILABILITY

TTP No.: CH3-6-T1-21
Subtask No.: 00
Contractor: BROOKHAVEN NATIONAL LABORATO
Revision: 00
HQ Office: TT
Date: 10/03/95
Fiscal Year: 1996

Spending Plan:

	EM-50 Funding	Other Funding	Total
PY-CO	0		
October	25	0	25
November	25	0	25
December	30	0	30
January	35	0	35
February	35	0	35
March	35	0	35
April	35	0	35
May	35	0	35
June	40	0	40
July	40	0	40
August	35	0	35
September	30	0	30
FY-CO	0	0	0
TOTAL	400	0	400

TTP: NORTHEAST WASTE MANAGEMENT ENTERPRISE (NEWME)

PART II: Task Justification
PURPOSE

The purpose of this project is to accelerate the commercial availability of new technologies that can be utilized by the DOE Environmental Management program to remediate its sites efficiently, rapidly, and in an environmentally acceptable manner. This commercialization/utilization goal will be accomplished in coordination with EM Focus Area groups, and will give consideration to technologies originating within and outside of the private sector.

TARGET PROBLEM

Environmental remediations and waste management at DOE (and other) sites can be expedited, often at significantly lower costs, if new technologies presently under development could be quickly brought to the commercial marketplace. DOE, as a purchaser, would then have an array of technologies available to it for expedited site remediations.

The massive and complex process of DOE site restoration has been formally underway since 1989. Since that time, it has become obvious that there is a natural conflict between the necessity to accomplish the remediation process as quickly as possible, and the corresponding need to utilize technologies that are simultaneously the best, least expensive, and most environmentally benign. Anticipating this problem, the DOE Environmental Management (EM) program established an Office of Technology Development (OTD), whose mission is to identify new technologies and to facilitate their introduction as appropriate.

OTD has determined that environmental remediation and waste management at the DOE (and other) sites could be expedited, often at significantly lower costs than current technologies impose, if new technologies presently under development could be brought to the commercial marketplace. To do so can require additional technical and economic information, as well as business planning and investment capital. Unfortunately, these components are often wanting, particularly for technologies developed within the national laboratory framework. As a result, many promising technologies are simply unavailable to the DOE because they are not commercial products.

To accomplish its mission OTD has created a unique program that unites the public and private sectors in a concerted effort to make new technologies commercially available to DOE/EM on a time scale that is relevant to its needs. The success of this effort depends upon a number of factors in addition to the obvious goal of creating a rapid technology deployment capability. It requires that some decisions be made by EM as to its deadlines for completing its overall mission; this may necessitate renegotiation of some agreements already in place, and it will raise the key issue of how the conclusions drawn from basic research programs can be translated into useful, commercially realizable technologies in a timely fashion.

The end-point in the process of making embryonic technologies commercially available is attraction of investment capital. A complete description of the technology is required, focusing on its niche in the marketplace, and its ultimate profit-making potential. Additional considerations relate to the business entity seeking to commercialize the technology include, for example, does the entity (e.g., individual scientist or company) have sensible business and strategic plans, capable management, and can it attract sufficient venture capital.

The problem outlined here has been addressed by the Assistant Secretary for Environmental Management, and his Deputy for Technology Development. In fact, the formation of the organization referred to in this TTP as NEWME (Northeast Waste Management Enterprise) was a direct consequence of a visit to BNL by the Deputy Assistant Secretary for Technology Development. Thus, this TTP is clearly appropriate for EM funding provided that the level of support is high enough to ensure the completion of the process of making technologies available.

SOLUTION DESCRIPTION

Background

The nature of the tasks identified in this document define it as a non-technology proposal. It must be noted at the outset that the problem discussed in the preceding section, namely, facilitating the commercial availability and utilization of environmental technologies, does not have a unique solution. Potentially valuable technologies can be found in various stages of development by individuals or consortia whose interest in the commercialization process ranges from intense to none. Even when the technologies reside in the private sector, they may be in the hands of highly- qualified scientists and engineers who possess little entrepreneurial skill or formal training in the methods that are required to conduct market analyses, prepare business and strategic plans, or secure financing or manage a business - all of which is required if a technology is to be commercially available. This is the challenge that NEWME will address in the forthcoming years to assist EM in its mission.

The primary partners in NEWME, Brookhaven National Laboratory and the Long Island Research Institute (LIRI), have the appropriate demonstrated combination of technical and economic skills to perform the tasks implied by the technology availability objective, and have ready access to additional expertise in sister laboratories and in academia, business, and the financial sector when necessary. Moreover, these local strengths are enhanced through access to the services of other technology availability team members.

This team approach optimizes the overall effort through a sharing of experience and resources in various regions of the country in dealing with stakeholders, regulators, and customers. A common database, GNET, will provide all team members with immediate access to a worldwide network of technologists and associated information.

In conjunction with individual EM focus areas, NEWME will perform a series of tasks whose outcome will be the commercial availability of new services or technologies. These technologies will have been selected specifically because they address the needs of one or more focus areas. The primary measure of accomplishment will be that the DOE can purchase the new service or technology from the private sector with accompanying cost and performance data to ensure their acceptance by regulators and stakeholders, and, therefore, utilization at DOE sites.

The approach to meeting the primary objective is one that depends upon cooperation and close collaboration between the focus area teams and NEWME. It utilizes methods that have been tested successfully by BNL and LIRI in their respective arenas of business: technical and economic.

Because there are five focus areas, which are in different phases of development, and budget constraints exist in FY96, it is reasonable to plan on interacting with only one focus area group initially. Success with one focus area should encourage other focus areas to participate with NEWME, thereby ensuring continuity of the commercialization effort.

For a given focus area, the pathway to technology availability consists of the five steps outlined below:

(1) All near-commercially-ready technologies in the focus area are identified. It is assumed that they have been judged by the focus area team on the basis of their potential relevance to some specific need. Presumably, technologies that could be of value to other focus areas have been flagged by the focus area team, and have been added to an appropriate database.

(2) The technologies identified in step 1 are matched with specific needs. It is probable that this step will have been taken by the focus area team in advance, but it is included here for the sake of completeness in this outline.

(3) Technical and economic criteria are used to prioritize technologies identified in step (2), for example,

(a) Probability of technical success. This assessment will be very case specific, depending as it must on the status of cost and performance data for the technology in question. It will be necessary to determine if EM-30, EM-40, or EM-60 are willing to support pilot scale demonstrations or if proof-of-principle research is still required. An estimate of the time required to reach the point at which technical availability can be optimistically predicted will be a critical factor in the decision-making process.

(b) Market assessments (commercial viability). In the present context, there are really two relevant kinds of market assessments to be considered. First (and foremost) is the market in which the customer is the DOE; if a strong market pull cannot be established in this case, then the technology is clearly not a candidate for further consideration. But satisfaction of the DOE demand may not be sufficient to meet the demands of investors who might be seeking assurances that there is also a non-federal market for the technology, for example, in the international marketplace. This second kind of assessment can be a critical one for a startup company.

(4) The specific steps and level-of-effort required by each company or technology to establish its availability will be determined. A number of questions are implicit in this step, for example,

(a) Is the technology already in the private sector or not?

(b) If the technology is in the private sector, what kind of assistance does the company need in formulating a business plan, financing, management, etc.?

(c) Are there technical improvements that can be made (e.g., through collaboration with a federal laboratory or university)?

(d) Does it require licensing-in of complementary technology?

(5) Services will be provided as necessary at the level-of-effort determined in step (4). For example,

(a) the development of business and strategic plans,
(b) establishment of technical support agreements,
(c) access to venture capital or other funding options, and
(d) identification of strategic partners.

NEWME will emphasize those technologies for which potential commercial availability are possible within a short (e.g., 12 month) time frame. Bringing to bear its pre-existing ties with businesses, and venture-capital individuals and groups (including LIRI's Long Island Venture Fund), NEWME will strive to actually bring to the DOE marketplace several of the most promising technologies. The measure of success will be actual technologies made available to DOE, as purchaser, for use at DOE sites.

EM-50 has funded NEWME for two fiscal years beginning in late FY93 at a total cost of $650K. During that period, NEWME has written its own work plan and a strategic plan, and has carried out the process outlined above in the five-step approach as far as possible under this very restrictive budget constraint.

Although NEWME will eventually consider a broad range of technologies defined by the interests of its focus group collaborators, its program actually began before the focus groups were organized. Therefore, in the absence of any dialogue with the focus area groups, an initial decision was taken to concentrate on four technical areas which were likely to overlap with EM focus areas when the latter eventually formulated their plans. The four areas are landfill containment, bioremediation, pyrolysis and waste stabilization/ash utilization. These areas have much to do with waste minimization and pollution prevention, and the experience gained in dealing with them is immediately transferrable to other technologies and relevant to all focus areas.

Several NEWME publications are available that document some of the information mentioned above. They are available from LIRI or BNL:

Goland, A., Petrakis, L., Eds. Recycling Technologies and Market Opportunities, Proceedings of a Conference held at Brookhaven National Laboratory, Upton, NY, September 20, 1993. BNL 52421, September 1993.

Strategic Plan for the Northeast Waste Management Enterprise, BNL 52441, November 1994.

NEWME News, Homer Goldberg, Editor, Volume 1, January 1995.

Goland, A. and Kaplan, E. Northeast Waste Management Alliance, Annual Report FY 1993, BNL 49841, November 1993.

Reaven, S., A Summary of the Report on Prospects for Pyrolysis Technologies in Managing Municipal, Industrial, and Department of Energy Cleanup Wastes, BNL 61006, August 1994.

Reaven, S., "Prospects for Pyrolysis Technologies in Managing Municipal, Industrial, and DOE Cleanup Wastes, BNL 52452, December 1994.

Internal memos describing and assessing commercial readiness of various FSU technologies

Technical reports and publications by principal investigators describing their technologies.

BENEFITS

EM-50 program managers have been rightfully concerned with the so-called Valley of Death for some time. One obvious response to the problem is a concept like that discussed in this Technical Task Plan, a concept whose primary goal is to facilitate the commercial availability of EM-relevant technologies on a time scale that is meaningful to the existing schedule of obligations faced by the focus areas. A subsidiary goal is to use guidelines that include the possibility of selecting technologies that also have the potential for applications beyond the DOE and indeed beyond the national borders of the U.S.

Attainment of the dual objectives of rapid deployment within the DOE complex and creation of a strong, internationally competitive environmental industry would constitute benefits that would amply justify the expenditure of EM-50 funds. Moreover, the principals in NEWME believe that these goals are achievable provided there is an integrated effort on the part of all EM participants, as well as sufficient funding to support the level of effort required.

TECHNOLOGY TRANSFER

This activity focuses directly on the transfer of technology, both into and out of the DOE complex. NEWME is focusing its efforts specifically on the private industry sector as the ultimate vehicle for the financing, manufacturing, marketing, and application of each technology with which it is involved. Transfer to the DOE complex (i.e., EM30, EM40, EM60, etc) is accomplished through the private sector.

Technology availability and technology transfer go hand-in hand. If the former does not occur the latter generally cannot happen either in the context addressed in this program. In principle, a limited set of technologies such as software or single units of specialized hardware could be transferred from site to site without benefit of a commercial entity. These kinds of activities are not encompassed by the NEWME process, nor should they be.

In addition, the more conventional meaning of technology transfer, as often practiced, also does not satisfy the need for rapid technology availability. Thus, the NEWME concept was created to bridge the gap, and serves to expedite commercialization from within and outside the DOE by means that are appropriate in each instance to the manner in which the technology was developed and its state of readiness for commercial application.

As part of its commercial readiness procedure, NEWME directly addresses the important issue of regulatory concern. As part of its accomplishments to date, NEWME has reached an understanding with local and state environmental regulators concerning their interest, and participation in, various demonstrations and assessments of environmental technologies. In the activities described in this TTP, each technology originator must provide information necessary for a regulatory agency to determine whether the process meets applicable concerns, or whether additional information is required before a decision can be made. In the latter case NEWME works with the technology originator to determine a protocol (including need for additional funding) which would provide the necessary information.

A key issue involves intellectual property rights (IPR). In the case of technologies developed at federal facilities, IPR are determined by both existing federal procedures and, in normal circumstances, direct negotiations with outside interests (e.g., venture capitalists). NEWME draws on the extensive experience at LIRI to facilitate resolution of potential IPR difficulties.

Each technology with which NEWME is involved will require a private sector industrial partner for ultimate commercialization. That is, either an existing company will be utilized for the commercialization of a technology (e.g., via a direct licensing arrangement), or a new company will be formed to specifically market the technology (e.g., via joint ventures). The commercial availability of a technology will be ensured given LIRI's pre-existing contacts and successes with the investment capital community.

STAFF/ORGANIZATION QUALIFICATIONS

Each of the participants in NEWME performs a well defined set of functions. As the coordinating organization, LIRI provides management and guidance from the pre-competitive stages of a project through its early commercial development. BNL is responsible for technical aspects of NEWME and for coordination with other federal laboratories.

The Long Island Research Institute was created by Brookhaven National Laboratory, the State University of New York at Stony Brook, Cold Spring Harbor Laboratory, and North Shore University Hospital as a non-profit entity specifically to commercialize technologies from research laboratories and to foster productive interactions between research institutions and industry. LIRI's Board of Directors and its Scientific and Business Advisory Council already include senior representatives of the region's technical, industrial and financial communities. Furthermore, LIRI's senior management have extensive experience in managing large scale multi-disciplinary technical projects.

Several resources at DOE National Laboratories provide important strengths to NEWME. The Environmental and Waste Management Center in BNL's Department of Advanced Technology has recognized expertise in areas related to mixed wastes. These include materials development for containment, encapsulation, and in-situ establishment of barriers. Researchers have also developed new technologies in groundwater and air pollution monitoring devices. Researchers in BNL's Department of Applied Sciences have developed ultra-low concentration per fluorocarbon tracers, and are investigating the role of naturally occurring microbes in waste degradation and transformation, and advanced materials development for landfill containment and corrosion resistance.

Resumes of BNL and LIRI principals are attached to this TTP: A. Goland (BNL), E. Kaplan (BNL), P. Palmedo (LIRI), and J. Wortman (LIRI).

PART III: Task Execution Plan

PRIOR-YEAR PROGRESS

Examples of work performed, sponsored or in progress in the NEWME program include the following:

(1) Evaluation of a patented three-stage process developed by Dr. A. J. Francis and his colleagues at BNL as an alternative to bulldozing contaminated high-clay soils at the RMI industrial site in Ashtabula, Ohio. Recent analyses indicate that the process can be highly effective for U-235 and Tc-99. Further work on recycling the citrate waste stream will be necessary and consideration will be given to establishing a demonstration project on the RMI site. This activity has involved Parsons Environmental Services, Inc.. NEWME has functioned as a facilitator in this effort and has provided very modest funding to advance it.

(2) Verification that ash (e.g., fly and bottom) may be encapsulated successfully in virgin polyethylene will be the basis for extending such feasibility studies to the substitution of recycled plastics, thereby achieving two objectives in one process: ash stabilization and recycling of plastics. Both of these contribute to the current DOE goal of waste minimization. NEWME has contributed financially to this project.

(3) NEWME has begun a collaboration with the National Center for Manufacturing Science to develop a major five-year project on the recovery, characterization and reuse of durable plastic materials derived from the automotive and computer industries. Active participants at present include: General Motors (the industrial champion of the project), Ford, Chrysler, DuPont, DOW, AT&T, Texas Instruments, IBM and the American Plastics Council. In addition to BNL and LIRI, the State University of New York at Stony Brook and Argonne National Laboratory are expected to play significant roles in this endeavor. Inasmuch as the NCMS operates on membership contributions and block grants from the DOE and the DOD, ultimate funding of the project will depend upon decisions made in the two agencies. The project has been divided into various phases, and Phase I has been funded. Discussions are ongoing with both agencies to define the scope of future phases which have been described in the complete proposal.

(4) Joanne Wortman, the co-manager of the NEWME project for LIRI, participates in the organization of the New York State Environmental Business Association, and is treasurer and a member of its Board of Directors. This provides NEWME with valuable contacts in a growing network of environmental companies in the State and rapid communication of new technology developments that can be evaluated for their relevance to the DOE.

(5) In collaboration with representatives of Professional Services International, NEWME principals Ed Kaplan (BNL) and Phil Palmedo (LIRI) traveled to Moscow in September 1994 to participate

in Moscow-94, the First International Environmental Technology Business Action Conference. Preparatory work accomplished during an earlier trip to Russia and Ukraine paid off at Moscow-94 when nine agreements of various kinds were made between U.S. and Russian organizations. This was believed to be a record for the conference.

(6) In relation to its participation in Moscow-94, NEWME evaluated the economic feasibility of portable ozonation technology developed by a Russian commercial entity. It was determined that similar technologies were already commercially available in the West, and this information was communicated to the Russian technologists, leaving open the possibility of collaborations with U.S. manufacturers in the future.

(7) Subsequent to its participation in Moscow-94, NEWME was contacted by an academician of the Institute of Biochemical Physics at the Russian Academy of Sciences interested in commercializing an organic sorbent potentially capable of sorbing various hazardous organic and radioactive substances. NEWME is presently working with the principal and biochemists at BNL to determine the technical merit of the sorbent.

(8) A comprehensive report was written on prospects for pyrolysis technologies in managing municipal, industrial, and DOE cleanup wastes. The study and report were completed by Dr. Sheldon Reaven, a professor in the College of Engineering and the Waste Management Institute at the State University of New York. Although technically the pyrolysis concept is an old one, NEWME is seeking new approaches that could demonstrate the feasibility of modular, easily transportable units for use economically on many DOE sites. The idea of utilizing pyrolysis technology has recurred periodically as a replacement for incineration, and the study concluded that it now appears to be the appropriate time to attempt a definitive evaluation of this process inasmuch as incineration has been discredited in the eyes of the public.

(9) A request for expressions of interest in demonstrating a pyrolysis technology was issued by NEWME and appeared in the Commerce Business Daily. It elicited about twenty responses which are currently being evaluated.

(10) A newsletter entitled NEWME NEWS was inaugurated in FY95 and was widely disseminated as hardcopy and electronically.

These and other activities would not have been possible if the NEWME program were not leveraged by support from New York State through its funding of LIRI. Additional funding of LIRI through its other commercialization activities helps to ensure the continuity of its infrastructure and is in itself a form of leveraging which benefits NEWME.

WORK ELEMENT DESCRIPTIONS

A. Task Management.- As described in its business and strategic plans, each of the participants in NEWME performs a well defined set of functions. As a coordinating organization, LIRI provides management and guidance from the perspective of the business community. BNL provides overall management of the project, as well as acting as technical manager and liaison with other federal laboratories. This task will provide monthly progress reports to EM describing both technical activities and necessary cost information.

B. Identify Landfill Focus Area relevant technologies that have potential for commercialization.- All technologies already identified by the landfill focus group will be reviewed in terms of whether sufficient information exists to positively state their relevance: technologies that could be of value to other focus areas will be added to an appropriate database (e.g., GNET). Because each technology will have already been examined to some degree by the landfill focus group, it is anticipated that this activity will require a relatively short amount of time and effort, perhaps as little one person-month. This screening activity will principally involve staff at BNL and LIRI, and will involve close coordination with members of the landfill focus group. Milestone: list of candidate landfill technologies finalized.

C. Identify Market Pull.- Quantify non-DOE demand for hazardous soil remediation (other federal, commercial, and international sites). Milestone: non-DOE market survey completed.

D. Employ Technical and Economic Criteria to Prioritize Technologies as Candidates for Commercialization/Utilization.- This task will identify which technologies are closest to commercial availability. Both the technical and economic viability of each technology will be assessed. Staff at BNL and elsewhere (i.e., various academic institutions) will evaluate the probability of technical success for each technology identified by the previous two work elements. This assessment will be very case specific, depending as it must on the status of cost and performance data for the technology in question. It will be necessary to determine if EM-30, EM-40, or EM60 are willing to support pilot scale demonstrations. An estimate of the time required to reach the point at which technical availability can be optimistically predicted will be a critical factor in the decision-making process.

Staff at LIRI will perform market assessments to determine commercial viability. Two kinds of market assessments will be considered: (1) that in which the customer is the DOE, and in which a strong market pull must be established for the technology to qualify for further consideration, and (2) whether a non- federal market exists for the technology, which may be necessary for various potential investors. It can be expected that this second kind of assessment will be critical for startup companies.

It is anticipated that only those candidate technologies in the top 10-25% will be used in subsequent activities. The level-of- effort of this activity depends upon the total number of technologies initially identified by the landfill focus group, and the degree to which sufficient information either exists, or may be gathered, to make technical and market assessments. This work element could require at least six to eight person-months, and could conceivably consume most project funding, unless NEWME and focus group staff work together to determine which cleanup needs are most important. This will shorten the list of target technologies. Milestone: all technologies that exhibit the potential for successful commercialization are selected.

E. Determine Level-of-Effort Required by Each Technology to Establish Its Availability.- LIRI staff will use information generated by the previous work element to evaluate the effort required to generate the information needed to attract outside investment. For each candidate technology, this activity will result in a verbal statement, and priority ranking, which will be used in discussions with EM staff to determine whether or not to proceed further.

This determination will depend on answers to questions such as (1) is the technology already in the private sector or not, (2) if already in the private sector, how much assistance does the company need in formulating a business plan, a strategic plan, etc., and (3) is the technology nearing a state of commercial readiness or not?

This activity will result in a selection of those candidates, perhaps no more than 5-6, for which remaining funds could be used to bring the technologies to the marketplace. This activity is anticipated to require several meetings with EM staff, and will take approximately one person-month to complete. Milestone: final selection of candidate technologies for commercialization completed.

F. Ensure the Organization of a Demonstration If One is Necessary.- This activity will only be required for those technologies with a high potential for commercial success, but for which critical technical information is lacking. It is important to note that this work element will be active only in those cases for which EM- 30, EM-40, or EM-60 are willing to support pilot scale demonstrations. The cost and duration of this work element is wholly dependent on results of deliberations of EM personnel, and the extent to which regulators and stakeholders become involved in the decision-making process.

G. Develop Commercialization Plans.- This activity will principally involve staff at LIRI, who will provide services as necessary at the level-of-effort determined in step (4). These include, for example, (1) business plans, (2) strategic plans, (3) access to venture capital or other funding options, and (4) identification of strategic partners. Based on their experiences to date, LIRI estimates this activity to require six person-months for each technology, depending on how much assistance the individual or company (if it exists at all) needs in formulating business plan and strategic plans. Milestone: commercialization plans completed.

H. Facilitate Commercial Implementation.- Again, this activity will principally involve staff at LIRI, who will provide services as necessary to bring candidate technologies to the DOE and private marketplace. LIRI estimates this activity to require 6-12 person- months for each technology, depending on how much effort will be required to attract outside investors, to address the issue of intellectual property rights, etc. Ultimately, this work element will result in the commercial availability, to DOE and others, of specific technologies for environmental cleanup and waste management. The time required to achieve effective utilization of these technologies will depend heavily upon the integration of stakeholder and regulator input into the commercialization strategy. Milestone: one or more commercialized technologies made available to DOE.

I. Provide Additional Support to EM (International, other).

CONSOLIDATED FUNDING AND BASIS

Major cost item - LIRI subcontract.

Prior experience of BNL and LIRI justifies costs of work elements, especially costs of commercialization.

KEY ISSUES

The key issue will be maintaining close contact with the focus area as it advances towards technology implementation under its various prior agreements. Reconciling existing deadlines with the introduction of new technologies will require some renegotiation of agreements with regulators and stakeholders. This may turn out to be the major stumbling block in the technology availability process, and a solution is not obvious.

A second issue could be the perception that the entire commercialization process is not generating as much leveraged funding as originally anticipated. A realistic appraisal of this potentially contentious situation should be made in discussions that involve EM-50 management so that it does not arise midway through a commercialization project.

NEPA/REGULATORY COMPLIANCE APPROACH

Not applicable.

BUDGET EXPENSE SCHEDULE

Budget Expense for FY 1996:

Mo/Yr	Total ($)
October 1995	25
November 1995	25
December 1995	30
January 1996	35
February 1996	35
March 1996	35
April 1996	35
May 1996	35
June 1996	40
July 1996	40
August 1996	35
September 1996	30
	400

Attachment

Resumes of BNL and LIRI Principals

Allen N. Goland, Senior Physicist and Division Head
Applied Physical Sciences Division
Department of Applied Science
Brookhaven National Laboratory
Ph.D., Physics, Northwestern University

Approximately forty years experience in materials science research and management including responsibility for capital projects and design of laboratory facilities. Formerly Head of research group in the Physics Department at Brookhaven National Laboratory. Subsequent experience as Associate and Deputy Chairman of the BNL Department of Applied Science, a large department with programs in environmental science and in basic energy science. Former Member of DOE/EM-50 Strategic Laboratory Council (SLC), Member of BNL Site Technology Coordinating Group (STCG), Co-principal investigator and Co-originator of NEWME program since its inception in 1993.

Edward Kaplan, Scientist and Group Leader
Internal Dose Assessment Group
Radiological Sciences Division
Department of Advanced Technology
Brookhaven National Laboratory
Also, Visiting Associate Professor
College of Engineering
State University of New York at Stony Brook
Ph.D., Environmental Systems Engineering, University of Pennsylvania

Twenty-five years experience in environmental systems and radiation effects engineering. Management experience includes supervising scientific/professional staff, directing research, and developing new projects in areas of environmental monitoring, numerical modeling, radiation bioassays, and internal dose assessments. Teach graduate courses in environmental systems engineering and numerical modeling, and advise masters-level students in their thesis projects. Author of monographs and papers on risk assessments, groundwater monitoring, and modeling of groundwater contaminant transport. Developed multi-layer ground water samplers for hazardous wastes, organic substances and microorganisms, and membrane devices to detect chemical warfare agents. Co-principal investigator and Co-originator of NEWME program since its inception in 1993.

Philip F. Palmedo, President
Long Island Research Institute
Ph.D., Nuclear Engineering Massachusetts Institute of Technology

More than twenty-five years research, management, and entrepreneurial experience, including direction of regional, national, and international technical and policy studies and start-ups of software, energy conservation, and financial companies. Formerly physicist and Head, Energy Policy Analysis Group, Brookhaven National Laboratory, Founder and Chairman, International Resources Group, an international consulting firm; co-founder and President, Kepler Financial Management, Ltd.

Joanne E. Wortman, Project Manager
Long Island Research Institute
M.S., Chemical Engineering, Rensselaer Polytechnic Institute

Formerly staff engineer and task leader, Oak Ridge National Laboratory, where she conceived and supervised design, construction, and testing of chemical process facilities and equipment, including computer simulation of a nuclear fuel reprocessing plant. Manager of NEWME.

facsimile
TRANSMITTAL

to: Allen Goland
fax #: 7905
date: January 25, 1996
pages: 9 pages total, including this cover sheet

Allen-

1. Another resume from Harriman ... not too useful in my opinion. I called Tom Sexton and asked that he personally (not via his assistant Kolber) check out potential students before sending more resumes. Despite my instructions, Kolber doesn't seem to get the point of NEWME.

2. David sent the new draft TTP yesterday at COB ... looks ok to me ... let's plan on calling him soon. I cannot understand why he didn't know about our meeting!

From the desk of ...

Ed Kaplan, Ph.D., Leader
Internal Dose Assessment Group
Division of Radiological Sciences
Department of Advanced Technology
Brookhaven National Laboratory
Building 703M
Upton, NY 11973

facsimile

TRANSMITTAL

URGENT

---

to: David Berg
EM-552
U.S.D.O.E.

fax #: (301) 903 - 7238

date: January 24, 1996

pages: 1 page total, including this cover sheet

David-

Sorry you missed today's conference call ... we would like to schedule another for next week. How about Monday or Tuesday, mornings? Let us know which (either is OK) and please have your secretary set up a call in number (ask her to phone it to me ASAP so I can send out an appropriate fax).

What is your email number (easier communications)? Ditto for Skip (by the by, he didn't make the telecof either ... nor did Bonie)

Thanks,

Ed

Ed —
I didn't know
about it!
David

From the desk of ...

Ed Kaplan, Ph.D., Leader
Internal Dose Assessment Group
Division of Radiological Sciences
Department of Advanced Technology
Brookhaven National Laboratory
Building 703M
Upton, NY 11973

VOICE: (516) 282 - 2007
FAX: (516) 282 - 5810

Office of Technology Development

~~12/07/~~95
17:42:53

TTP
Summary
Title: NORTHEAST WASTE MANAGEMENT ENTERPRISE
Product Line: TI12 - DOMESTIC - TECHNOLOGY AVAILABILITY

TTP No.: CH3-6-T1-21
Revision: 00
Date: 12/07/95

Subtask No.: 00
Contractor: BROOKHAVEN NATIONAL LABORATORY
HQ Office: TT
Fiscal Year: 1996

Headquarters Focus Area Team Lead: DAVID BERG, EM-54 , 301-903-5135

Partner Focus Area Team Lead: ,

Headquarters Financial Officer: BARBARA WATSON, EM-131 , 301-903-7950

Technical Program Officer: STEVE WEBSTER, DOE-CH , 708-252-2822

Principal Investigator: ,

Joint Participants:

Jointly Funded Program: PROJECT FUNDED BY EM-50 ONLY

Primary Technology Area: To Be Determined

Secondary Technology Area(s): None

Primary Focus Area: TECHNOLOGY INTEGRATION

Secondary Focus Area(None

B&R Code: EW404020. Joint B&R Code:

Auxiliary Fields: 1. CA 2. 3.

Task/Subtask Summary:
Old TTP CH333501 :

NEWME's objective is the provision of services and formation of partnerships between industry, federal laboratories, academia, and other institutions in order to accelerate the commercialization of technologies that can provide cost-effective remediation at DOE sites and in other related non-DOE remediation markets. The Long Island Research Institute (LIRI) and Brookhaven National Laboratory (BNL) have developed a Strategic Plan for NEWME which outlines how regional resources can be harnessed to optimize the solution of environmental problems that relate to both DOE and non-DOE site remediations.

NEWME will match Focus Area solutions and needs with the needs of non-DOE problem holders, evaluate technical competitiveness, assess the national and global markets for designated technologies, and assemble teams of federal laboratory and commercial participants in order to further commercialization. This would include the identification and development of additional markets for advanced environmental technologies to assure their availability to DOE. NEWME draws on the pre-existing expertise of the Long Island Research Institute in finding commercial partners, assessing technologies, and markets, and finding sources of private capital for businesses that are commercializing EM-related technologies. In addition, NEWME will continue to evaluate the technologies covered in the agreements signed at Moscow 94. The system that is in place assures objective, unbiased analysis of technologies, as evidenced by recent NEWME activities:

NEWME is evaluating technologies from the Former Soviet Union under the aegis of the Moscow 94 Conference. - redundant ?

At the request of the National Center of Manufacturing Science NEWME is designing a collaborative program to address the recycling of plastics from durable goods. Industrial participants include, Ford, General Motors, DuPont, Dow, AT&T, and Eastman.

? see budget summary

With $750K in FY96 ($500K from EM-50, and the balance from other federal agencies, industry, or private sources of financing), NEWME will be the primary provider of commercialization assistance to the Landfills Focus Area.

Task 1: ($200K) 150 ?

Working with the Landfills stabilization Focus Area, apply the commercialization assistance screening process to the Landfills Focus Area technologies. The screening process will identify which technologies have the highest priority for receiving commercialization assistance from NEWME.

Task 2: ($300K) 250 ?

Provide commercialization assistance to the highest priority technologies identified with the Focus Area in Task 1. This funding may not be sufficient to provide assistance to all of the highest priority technologies.

Task 3: Perform other technology evaluations as identified by DOE.

Budget Summary (Dollars in Thousands):
B&R Code: EW404020

	TOTAL ACT TO DATE	1995 ACT	1995-CO	1996 R	1996 FUNDING TO DATE
OE	650	300	0	400	400
CE	0	0	0	0	0
GPP	0	0	0	0	0
LI	0	0	0	0	0
TOTAL	0	0	0	400	0
FTEs				0.00	

	1997 R	1998 R	1999 R	2000 R	2001 R	ALLSUBS YEARS	TOTAL
OE	0	0	0	0	0	0	400
CE	0	0	0	0	0	0	0
GPP	0	0	0	0	0	0	0
LI	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	400
FTEs	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Budget Summary Totals (Dollars in Thousands):

	TOTAL ACT TO DATE	1995 ACT	1995-CO	1996 R	1996 FUNDING TO DATE
OE	0	0	0	400	0
CE	0	0	0	0	0
GPP	0	0	0	0	0
LI	0	0	0	0	0
TOTAL	0	0	0	400	0
FTEs				0.00	

	1997 R	1998 R	1999 R	2000 R	2001 R	ALLSUBS YEARS	TOTAL
OE	0	0	0	0	0	0	400
CE	0	0	0	0	0	0	0
GPP	0	0	0	0	0	0	0
LI	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	400
FTEs	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level:
1	LIST CANDIDATE LANDFILL TECHNOLOGIES	11/30/95	CNTR

Description:

List all of the Landfill Focus Area technologies that are candidates for commercialization assistance.

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level
2	COMPLETE INITIAL SREENING	03/01/96	CNTR

Description:

Complete initial screening of Landfills Focus Area technologies to identify those having the highest priority for receiving commercializaton assistance.

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level
3	COMPLETE INITIAL SELECTION	04/01/96	CNTR

Description:

Complete selection of initial technologies for commercialization assistance.

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level
4	COMPLETE SCREENING	05/01/96	CNTR

Description:

Complete screening of Landfills Focus Area technologies to identify those having the highest priority for receiving commercialization assistance.

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level
5	COMPLETE BUSINESS AND/OR STRATEGIC PLANS	09/30/96	CNTR

Description:

Complete the preparation of business and/or strategic plans that will guide the commerialization assistance NEWME will provide to Landfills Focus Area technologies.

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level
6	COMPLETE NON-DOE MARKET SURVEY	12/31/96	CNTR

Description:

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level:
7	COMPLETE FY97 SCREENING UPDATE	03/01/97	CNTR

Description:
Complete the FY97 rescreening of Landfills Focus Area technologies to identify those having the highest priority for receiving commercialization assistance.

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level:
8	COMPLETE SELECTION	06/11/97	CNTR

Description:
Complete selection of technologies for commercialization assistance

Task/Milestone Summary:

Milestone Number:	Milestone Title.:	Due Date:	Level:
9	TECHNOLOGIES MADE COMMERCIALLY AVAILABLE	09/30/97	CNTR

Description:
One or more technologies made commercially available to DOE.

Drivers:

Waste Types:

HLW	TRU	TRU MIX	LLW	LLWM	HAZ	SANT	GTCC
N	N	N	N	N	N	N	N

Attachment 5

NEWME Technology Screening Process

LIRI-95-003

LANDFILL STABILIZATION FOCUS AREA

PROCESS FOR TECHNOLOGY SCREENING

December 7, 1995

neume

NORTHEAST WASTE MANAGEMENT ENTERPRISE

BROOKHAVEN NATIONAL LABORATORY
Upton, NY 11973

LONG ISLAND RESEARCH INSTITUTE
110 Lake Ave. S. Nesconset, NY 11767

The Northeast Waste Management Enterprise, NEWME, is a collaboration between Brookhaven National Laboratory and the Long Island Research Institute to facilitate the commercialization of environmental technologies, particularly as they address the needs of the Department of Energy.The basic objective of NEWME's work with the Landfills Stabilization Focus Area is to "achieve a portfolio of **commercially available** technologies to meet the needs of the EM cleanup mission[1]"(emphasis ours). NEWME's role is to concentrate on the commercialization process. There are two steps to be undertaken: 1) to determine which technologies now under development in the focus area most warrant commercialization assistance, and 2) to provide that assistance.

Screening of the Technologies

A framework to score technologies was designed to carry out the first step in the process (i.e., screening). It is important to note, however, that there is no purely quantitative, deductive method of arriving at a final, ordered list of technologies. Thus, the framework has been designed to facilitate what is inevitably a judgmental process.

The evaluation process includes a set of evaluation criteria, or "screens." There are 61 technologies currently on the Landfills Focus Area list[2]. Some may be taken out of the formal evaluation process for one reason or another, for example because they are at too early a research stage to justify commercialization assistance. Each will be scored numerically for each criterion on a scale from 1-5. The process, indicated in Figure 1, also includes a set of weights, allowing us to emphasize certain criteria over others. Inevitably, there is a certain degree of overlap between the six evaluation criteria, which can be accounted for through the weighting factors. The first three criteria evaluate the significance of the technology, with the remaining criteria indicating the technology's closeness to commercialization. These six criteria are:

1. Technological Area

The 61 technologies are grouped into four categories: Landfill Assessment, Retrieval, Treatment, and Containment/Stabilization. Each category will be given a score commensurate with its importance in accomplishing EM's mission. (Thus, all technologies in a category are given the same score for this criterion.)

---

[1] David R. Berg and Jaffer Mohiuddin, Memorandum to Clyde Frank, October, 1995

[2] DOE Office of Environmental Management, Technology Development, "Landfill Stabilization Focus Area; Technology Summary," June, 1995, DOE/EM-0251

2. Potential Impact

The objective of the EM technology development program is to make available technologies that are "better, faster, safer and more cost effective than those currently available"[2]. The Potential Impact criterion estimates the potential benefit of the technology when it is fully developed and available in those terms. For the economic benefit, for example, the indicator is unit savings x the size of the problem addressed by the technology. Although this, as well as all other scoring in the system will be, of necessity, subjective, it will draw upon, and be consistent with, any applicable quantitative DOE cost benefit analyses .

3. Technological Competitiveness

While the previous criterion deals with a general class of technology, this criterion evaluates the competitiveness of the specific technology under consideration. When the technology is fully developed, how will it compare in performance with other technologies meeting the same need? How complete is the technology - does it do the complete job or does it depend on the development of related technology? Is it broadly applicable, or is it limited to only certain types of landfills? Does the technology complete the ability to solve a particular problem?

4. Intellectual Property Rights[3]

This criterion evaluates the strength of the intellectual property (I.P.) inherent in the technology and the degree to which that I.P is protected and licensed. Technologies that have significant patent protection and where the intellectual property has been licensed will score the highest.

5. Technological Maturity and Economic Competitiveness

This judges how close the technology is to being available for use in the field at the performance level assumed in evaluating criterion 2 (Potential Impact). For example, if portability of the technology is critical, how far is the technology from being portable? How close is it to having a significant cost advantage over competing technologies.

6. Commercial Capability

This criterion evaluates the capability of the involved company to commercialize the technology successfully. How strong is the company technically, managerially, and financially?

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[3] Criteria 4, 5, and 6 were suggested in the memo cited above from Berg and Mohiuddin.

NEWME will organize, research and structure the analysis using the methodology described above. However, there is no unique solution, and we anticipate an evaluation process involving several people familiar with the technologies and DOE's cleanup requirements and priorities (including EM staff and others involved in the Landfills Stabilization Focus Area). The process will also involve alternative weightings and methods of combining weights so that we can have confidence in the robustness of the final priorities.

The Questionnaire

NEWME will interview those involved in developing the 61 technologies (or those remaining after an initial sorting) in order to:

1. Acquire information necessary to rank the technologies according to the criteria described above, and

2. Determine, particularly for those technologies near the top of the list, what kind of assistance is required to accelerate their commercial availability. What are the technical, economic, and commercial barriers to be overcome? If the technology is licensed, what kind of assistance, if any, is required by the company?

Figure 2 presents the draft of the screening questionnaire intended to accomplish both of those objectives.

Commercialization Assistance

Technologies with the highest rankings after the screening process will be selected for commercialization assistance. A Commercialization Assistance Plan (CAP) will be developed for each such technology, based on information gathered during the screening process, as well as more detailed conversations with company officials. If necessary, NEWME will help the company develop business and strategic plans and identify strategic partners or outside sources of capital (e.g., venture capital) to help bring the technology to the marketplace.

Figure 1
Screening Form

Technology	W1=___ Technological area	W2=___ Potential Impact	W3=___ Technological Competitiveness	W4=___ Intellectual Property Rights	W5=___ Technological Maturity and Economic Competitiveness	W6=___ Commercial Capability	Combined Score

Figure 2
TECHNOLOGY SCREENING QUESTIONNAIRE

W1: Technological Area

Which Landfills need(s) are addressed by the technology?

W2: Potential Impact

List all primary and secondary applications of the technology.

Are there estimates of the technology's impact when it is fully implemented, in terms of its being better, faster, safer, or more cost effective than competing technologies?

Does the technology address a problem for which no solution exists?

Does it fill a void in our ability to cleanup a particular situation?

What are the non-DOE markets for the technology?

What are the sizes of the markets (DOE, other federal, domestic, international)?

W3: Technological Competitiveness

What are the competing technologies?

Who owns them?

How well do they perform?

How much do they cost?

W4: Intellectual Property Rights

Have any patents been applied for or issued?

To whom are they assigned?

Are there existing licenses or agreements to license? If so, what are the terms?

Are there any impediments to licensing?

W5: Technological Maturity and Economic Competitiveness

What is the technology's state of development?

What are the critical issues that remain to be addressed (science, technology, scale-up, environmental)?

What further scale demonstrations are necessary?

What complementary technologies are necessary for implementation?

What are the application limitations (completeness of solution)?

Description--is the Rainbow Book description current?

What is needed before the technology is available in the field as an off-the-shelf item or service?

When will the technology be field portable?

What is the current cost of the technology?

What will the cost be when it is field portable?

What is the current economic maturity?

Has the technology received any regulatory approval?

What additional regulatory issues need to be addressed?

Are there any liability issues?

W6: Commercial Capability

For companies already significantly involved:

What size is the company?

Is it publicly or privately owned?

Is an annual report available?

What are the annual revenues?

What relevant experience does the company possess?

What is the company's capability and interest in commercializing the technology?

Attachment 6

SUBCON Technology Evaluations

June 5, 1996

OFF GAS TREATMENT TECHNOLOGIES

At the request of Jack Corey, NEWME is investigating treatment options for retrofit of an existing Savannah River Remediation site. The current treatment train is shut down nearly fifty percent of the time because HCl emission limits are exceeded. We examined total air flow rates of 300-600 scfm, and the following contaminant concentrations:

	ppmv	ppmv
PCE	16,000	800
TCE	3,000	1,500
TCA	500	250

Presented below is a summary of the information received to date, and suggested follow-up action.

PADRE VOC Treatment

The PADRE system, developed by PURUS, is now being marketed by Thermatrix, Inc. I spoke with Richard E. Scheig, Sales Director for PADRE (303-989-3793), who recommended use of the A3100 Thermatrix PADRE VOC Recovery System. This is a two-bed system capable of treating roughly 5-7 lb/hr of chlorinated compounds (300-600 scfm). This system can achieve 95% removal of chlorinated hydrocarbons at 6" Hg.

COST INFORMATION FOR PADRE VOC RECOVERY SYSTEM	
INSTALLATION, START-UP AND TRAINING	$250,000
OPERATING COST (UTILITIES + LN2)	$1/hr
SOLVENT REMOVAL	$100-150/55 gallon drum

Thermatrix has submitted a proposal to John Steele and Jim Owendorf for use of their thermal VOC treatment technology at the Savannah River Site. Mr. Scheig expressed confidence that that contract would be awarded this week. Since the company has performed technology demonstrations at Savannah River, and hopes to perform remediation work at the site, they would prefer to deal directly with Westinghouse-Savannah River people if there is an interest in using PADRE for the retrofit. PADRE is a more appropriate technology for the design conditions specified for the retrofit.

CORONA OFF-GAS TREATMENT

After a lengthy delay in obtaining and executing the confidentiality agreement requested by PNL, we received the first information on this technology on 6/4/96. The information addresses TCE and PCE removal, but does not refer to any prior experience with TCA. This technology was tested at Savannah River in 1993. The following cost information was quoted for a system that treats 1200 scfm:

SUMMARY OF COST INFORMATION FOR CORONA OFF-GAS TREATMENT 1200 1200 scfm	
Capital Cost	$116,000
Annual power cost	$23,000

Bionomic Industries of Mahwah, NJ was working under a CRADA with PNL to design and construct a commercial prototype system.

OUTSTANDING ISSUES:

- Can the system address TCA?
- What is the status of the Bionomics CRADA?
- Is Bionomics interested in selling the systems to DOE?
- Evaluation of Bionomics' commercial strength

Purus Off Gas Treatment

Which Landfills need(s) are addressed by the technology?

The PURUS PADRE™ treats VOC-contaminated air streams that arise from soil vapor extraction wells or from air stripping of ground-or wastewater. Within the Subsurface Contaminants Focus Area, it can be used in the treatment of VOC-contaminated soil or groundwater.

List all primary and secondary applications of the technology.

Vapor streams containing organic solvents, including halogenated volatiles and semivolatiles, non halogenated volatiles and semivolatiles, solvents, BTEX[1]. The following industry sectors are likely to have VOC treatment needs: paint/ink formulation, pesticide/herbicide manufacturing, petroleum refining, dry cleaners, plastics manufacturing, and other organic chemical manufacturers and users.

Are there estimates of the technology's impact when it is fully implemented, in terms of its being better, faster, safer, or more cost effective than competing technologies?

Estimated costs $1.00 to $3.00 per pound of VOC, not necessarily including costs of permitting, excavation, and treatment of residuals.

Does the technology address a problem for which no solution exists? No

Does it fill a void in our ability to cleanup a particular situation? No

What are the non-DOE markets for the technology?

See industry sectors listed above. Other markets include NPL sites, DOD facilities.

What are the sizes of the markets (DOE, other federal, domestic, international)?

What are the competing technologies?

Who owns them?

How well do they perform?

How much do they cost?

Have any patents been applied for or issued?

To whom are they assigned?

Are there existing licenses or agreements to license? If so, what are the terms?

Are there any impediments to licensing?

What is the technology's state of development? This appears to be a mature technology.

What are the critical issues that remain to be addressed (science, technology, scale-up, environmental)?

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[1] Benzene, Toluene, Ethylbenzene, Xylene

What further scale demonstrations are necessary? None

What complementary technologies are necessary for implementation?

What are the application limitations (completeness of solution)? Purus cannot treat vinyl chloride.

Description--is the Rainbow Book description current? Additional description found at http://ramah.gecid.sandia,gov/BEST/techs/aa/tech0232.html and on EPA VISITT System.

What is needed before the technology is available in the field as an off-the-shelf item or service? Technology is ready now. 6 systems are in the planning/design phase, 3 are under construction, 2 have been constructed. 2 firms other than Purus have completed full-scale cleanups with this equipment.

When will the technology be field portable? It is transportable in its current design.

What is the current cost of the technology? \$1 - \$3/pound of VOC treated.

What will the cost be when it is field portable? Same as above.

What is the current economic maturity?

Has the technology received any regulatory approval?

What additional regulatory issues need to be addressed?

Are there any liability issues?

Commercial Capability

For companies already significantly involved:

What size is the company?

Is it publicly or privately owned?

Is an annual report available?

What are the annual revenues?

What relevant experience does the company possess?

What is the company's capability and interest in commercializing the technology?

PASSIVE SOIL VAPOR EXTRACTION

Naturally-occurring diurnal and weather-related changes in atmospheric pressure cause vapors in the subsurface to move across the interface between the soil and the air above it. The terms "barometric pumping" and "passive soil vapor extraction (PSVE)" are often used to describe this phenomenon. This natural pumping action was described early in the century by E. Buckingham (1904), who is generally credited with the first quantitative description of soil aeration. Barometric pumping is not confined to air in the soil, but acts upon any vapor that is able to diffuse through the specific soil matrix that it occupies. The efficiency of the pumping action depends in part upon the porosity, permeability, and extent of fracture of the earth matrix, and can be enhanced by the addition of wells or boreholes. A recent model of the phenomenon is presented in detail by L.H. Auer et al in a Los Alamos National Laboratory report, LA-UR-95-3033 (August 1995) .This report will appear in the Journal of Contaminant Hydrology in 1996.

In surveying the status of this technology, it became obvious that a sufficient number of demonstrations had been conducted or were in progress to furnish the necessary data for further commercialization action. In fact, an excellent evaluation of the economics of PSVE by Mark Cummings and Steven R. Booth of LANL has recently been published (1996). Relying on the results of field demonstrations and other experiments and analyses at Hanford (Virginia Rohay), INEL (Wayne Downs, William Shaw), LLNL (Joe Shinn), Savannah River Site (Joe Rossabi), and Mohawk Research Corp. (Marcia Rorke), these authors concluded that, "PSVE shows promise as a complement to Active Soil Vapor Extraction (ASVE). ASVE, is the most effective vapor extraction system when the initial concentration is in the thousands of parts per million. However, as the soil-gas concentrations decline, and the marginal cost of using ASVE becomes increasingly expensive, PSVE could be substituted for the remainder of the treatment lifetime." Moreover, at the edge of a contaminant plume the vented vapor concentrations may satisfy local Clean Air Act regulations without further attention, thus making the process very attractive as a *long-term remediation technique*.

Based upon the NEWME investigation, at this time the status of PSVE within the DOE complex with respect to commercialization appears to be one of benign neglect. An informal national group within the National Laboratories has assembled a detailed report of its experience with PSVE testing, but as of mid-FY96, permission to release it had not been granted. Funding for this group appeared to be ending in FY96, although each of the members who were contacted expressed great enthusiasm for the viability of the technology, and the hope that it would be commercialized soon. Several patents arising from DOE field work have been awarded or are pending, but these do not appear to be obstacles to commercialization. NEWME found one company, Longworth Environmental, Inc. (Gansevoort, N.Y. 12831), whose owner includes PSVE in his arsenal of remediation technologies, but this firm has not yet been successful in penetrating the DOE procurement bureaucracy. Conclusion: documentation is available from DOE-supported field demonstrations of PSVE to satisfy the needs of EM Focus Area leaders and potential commercial vendors, the former on technical matters, the latter on the economic viability of the technology. If the New Approach to EM-50 integration of technology is working, then PSVE should soon be under active consideration at all future SUBCON sites.

SUBSURFACE BARRIERS

DOE has funded several projects related to the emplacement and use of subsurface barriers to contain migrating plumes of contamination. These include the development of emplacement technologies (e.g., horizontal drilling, jet and panel jet grouting), the development and use of new grouts as barrier materials (e.g., mineral wax/bentonite emulsions, sodium silicate, and polymers such as sulfur polymer cement, vinylester styrene, polyester styrene, furfuryl alcohol, asphalt, and a high molecular weight acrylic), and the use of tracers [e.g., perfluorocarbon tracers (PFTs)] to test and verify barrier integrity. Additionally, DOE has funded field demonstrations at the Hanford (Washington) Geotechnical Test Facility, Fernald, and Savannah River.

NEWME investigated the demonstration of a subsurface close-coupled barrier emplacement at BNL to contain mixed chemical wastes in glass disposal pits. This concept utilized the concept of a multibarrier of cementitous grout followed by a polymer grout. The latter is bonded to the inside surface of the cement barrier. It was noted that the same concept was previously demonstrated at a smaller scale to enclose a buried tank at the Hanford site (where PFTs were demonstrated).

The BNL field demonstration (John Heiser, Principal Investigator) was performed in collaboration with Brian Dwyer, Sandia National Laboratory and Steve Phillips, AGEC Inc., a private grouting contractor who utilized panel jet equipment developed by Westinghouse Hanford Company. Discussions with demonstration participants resulted in the following conclusions: intellectual property right issues were largely unimportant (and were confined to the proprietary composition of particular polymers used as grouts), emplacement technologies exist for most DOE needs, and PFTs have been successfully used to demonstrate integrity of subsurface barriers. The most important issue from DOE's perspective is the need to facilitate the process by which DOE personnel responsible for waste management and site remediation at specific facilities become familiar with individuals and companies capable of utilizing existing subsurface barrier technologies.