

# Qualifications for Evaluation of Conventional and Emerging Technologies for Solid Waste Management



# ARI

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# QUALIFICATIONS FOR EVALUATION OF CONVENTIONAL AND EMERGING TECHNOLOGIES FOR SOLID WASTE MANAGEMENT

## 1.0 CORPORATE OVERVIEW

Incorporated in Massachusetts in 1984 as a Subchapter S corporation, Alternative Resources, Inc. (ARI) is an independent consulting firm that specializes in providing public clients with management, engineering, environmental and financial services for preparing feasibility studies and implementing solid waste management projects. ARI has provided services to hundreds of clients throughout the United States. Specific services are listed in Table 1.

**Unique, Unbiased Services:** ARI offers a unique combination of specialized, in-depth industry expertise with no affiliation to technology vendors.

ARI is owned entirely by private shareholders who are also employees of the firm, active in the day-to-day operation of the company. Important to any evaluation and implementation of emerging technologies is the fact that ARI does not have any affiliations with, nor does it currently work for any company that develops or operates emerging municipal solid waste conversion technologies. Therefore, ARI has no conflict of interest or bias in performing evaluation services or subsequent services during project implementation.

ARI's experience includes more than 300 solid waste projects for source reduction, recycling, composting, non-burning materials recovery, gasification, anaerobic digestion, waste-to-ethanol, waste-to-energy, incineration, transfer, landfill and methane recovery facilities. Projects range in size from 25 to 3,000 tons per day, for large cities and counties such as New York City and Los Angeles County, for counties, districts, and authorities, for suburban communities, and for rural communities with less than 1,000 people. Projects include use of conventional technologies and introduction of new, emerging technologies. ARI has been a leader in assessing the feasibility of emerging technologies for more than 20 years. Table 2 presents a summary listing of ARI's representative municipal solid waste experience.

**Financial Expertise:**  
ARI's economic and finance staff increase the depth of services offered for technology review and evaluation.

ARI's resources are organized in four major groups: Solid Waste, Water and Wastewater, Environmental Compliance, and Economics and Finance. Skills include mechanical, civil, chemical, and environmental engineering disciplines. Scientists provide expertise in air quality, meteorology, chemistry, and soil science. Economists provide the framework for integrating engineering and scientific analyses, providing life-cycle economic analyses and preparing financing plans. As appropriate, these skills are brought together on a project team basis to address client needs.

## Table 1

### **ALTERNATIVE RESOURCES, INC. SUMMARY OF SERVICES**

#### **Feasibility and Planning Services**

- Feasibility Studies
- Integrated Solid Waste Management Planning

#### **Implementation Services**

- System Conceptual Design
- Program Cost and Schedule Development
- Procurement
  - Development of procurement strategy (ownership and operating options, technology options, risk sharing, and financing options)
  - Preparation of procurement documents (Request for Qualifications, Request for Proposals)
  - Evaluation of qualifications statements and proposals
  - Negotiation and preparation of contracts
- Developing and Securing Waste-Supply Contracts
- Developing and Securing Recycled and Compost Material Markets Contracts
- Developing and Securing Energy-Sales Contracts
- Residue Disposal and Reuse Evaluations
- Engineering and Environmental Site Studies
- Environmental Permitting and EIS Preparation
- Specialized Environmental Services
- Public Participation and Approval Programs
- Identification and assessment of alternative project financing options
- Preparing Third Party Engineering Reports to Support Financing
- Liaison and Support to Investment Bankers, Rating Agencies, Lenders and Investors to Support Financing

#### **Design and Construction Related Services**

- System Design Review
- Construction Monitoring
- Program Management
- Acceptance-Test Plan Development
- Acceptance-Test Monitoring

#### **Operations Monitoring and Management of Solid Waste Systems**

- Operations Monitoring and Management for performance and contract compliance for collection, recycling, composting, conversion technology, waste-to-energy, landfill and transfer systems
- Review and optimization of solid waste management systems
- Strategic planning for future needs

**Table 2**  
**ARI REPRESENTATIVE MUNICIPAL SOLID WASTE EXPERIENCE**

<b>Integrated Systems</b>	<b>Recycling</b>	<b>Composting</b>	<b>Waste-to-Energy</b>	<b>Landfill</b>	<b>Transfer Station</b>
Greater Bridgeport SWAB, CT	SWEROC, CT	Quincy, MA	Greater Bridgeport SWAB, CT	Barre, MA	Somerville, MA
Vernon, CT	Housatonic Region, CT	Schuylkill County, PA	Lisbon, CT	Chicopee, MA	Braintree, MA
Manchester, CT	Bristol Region, CT	Cumberland County, NJ	Charleston, SC	Haverhill, MA	Concord, MA
Bucks County, PA	Enfield, CT	Lowell, MA	Savannah, GA	Granby, MA	Warren, OH
Northeast Maryland Waste Disposal Authority, MD	Vernon, CT	Burlington, MA	New York City, NY	Braintree, MA	Methuen, MA
Puerto Rico SWMA	Southeastern CT Regional Resource Recovery Authority, CT	Wilmington, DE	Robbins, IL	Taunton, MA	
Delaware, Knox, Marrion & Morrow Counties (DKMM)	Millis, MA	Sarasota, York, Volusia, and Palm Beach Counties, FL	Portland, ME	Plainville, MA	
Hudson County, NJ	Quincy, MA	West Cook County, IL	Braintree, MA	Concord, MA	
Northumberland County, PA	Robbins, IL		Millbury, MA	New York City	
West Cook County, IL	Maine Prison System, ME		Hudson County, NJ	Bedford-Fulton-Huntington Counties, PA	
Union County, PA	Regional Waste Systems - ME		Akron, OH	San Bernardino County, CA	
New York City	Framingham, MA		Clark County, OH	Coalition of Northeast Governors	
Great Barrington, MA	Monroe County, PA		Quonset Point, RI	Savannah, GA	
Lamprey Solid Waste District, NH	Allentown, PA		Lowell, MA		
Methuen, MA	Lowell, MA		Susquehanna/Wyo. Counties, PA		
Framingham, MA	New Bedford/Dartmouth, MA		Leominster, MA		
White River Valley, VT	Lexington, MA		San Bernardino County, CA		
New Bedford, MA	Maine Mall, ME		Durham, NH		
Concord, MA	Chestnut Hill Mall, MA		Bushkill, PA		
Lowell, MA	Damonmill Square, MA		Berks County, PA		
Charleston, SC	Bucks County, PA		Holyoke, MA		
	Wellesley, MA		Erie, PA		
	Warren, OH		Collier County, FL		
	Canton, OH		Auburn, ME		
	East Chicago, IL		West Cook Cty, IL		
	Cape Cod, MA		Onondaga Cty, NY		
	Chelsea, MA		Springfield, MA		
			Mercer County, NJ		
			Puerto Rico		
			St. Thomas/St. Croix, U.S. V.I.		
			Tri-County, MN		

## **2.0 SELECTED PROJECT EXPERIENCE**

### **2.1 Overview of ARI Experience**

ARI is an independent consulting firm that specializes in assisting public entities (e.g., communities, districts with multi-community membership, counties, states, and territories) assess the feasibility of and implement solid waste management, water and wastewater infrastructure projects. Services include not only planning and feasibility studies, but technology evaluations, procurement of facilities and services, contract negotiations, preparation of independent engineering evaluations for project financings, serving as the owner's representative for design review, construction monitoring, acceptance testing and operations monitoring, preparation of environmental impact statements and permits, and economic and financial services.

ARI's professional staff includes planning, engineering, environmental and financial experts. Solid waste services include those for source reduction and recycling, composting, resource recovery and landfill systems. Work has been performed on more than 300 projects in the United States and Puerto Rico, associated with conventional technologies as well as emerging conversion technologies. A particular strength of the company is in assisting public entities assess and implement public-private partnerships for environmental infrastructure projects, typically where a public entity contracts with a private company to design, build and operate publicly owned facilities and/or provide for public services through a contract with a private company.

ARI routinely prepares solid waste plans for its clients, including evaluation of current and future solid waste management needs, identification and evaluation of options, and implementation of solutions. ARI is cognizant of the strategic thinking and policy needs to achieve acceptance of solid waste plans by public officials and the public at large. In addition to our expertise in planning and our in-depth experience with conventional technologies, ARI is knowledgeable of emerging conversion technologies (including current status regarding technology development, environmental impacts and project economics). Consequently, we can effectively conduct a review of emerging technologies that facilitates presentation in a strategic plan. Also, our experience with material recovery facilities (MRFs) is worthy to note since such preprocessing is often needed and the output of such facilities can be a source of feedstock to conversion technologies.

To round out our experience with solid waste planning and volume reduction technologies, the last section of this Qualifications Statement presents ARI's qualifications to provide economic and financial services.

## **2.2 Representative Project Experience, Emerging Technologies**

ARI has been a leader in assessing the feasibility of emerging technologies for 24 years. Our experience with waste-to-energy technology (see Section 2.3) dates back to 1984, when what is now conventional technology was considered innovative. Highlighted in this section, however, are recent, relevant projects featuring emerging conversion technology review and development, as well as integration with strategic solid waste planning efforts. Key projects were conducted for New York City, New York, Los Angeles County, San Diego, the City and County of Santa Barbara, the Sacramento Municipal Utility District, California, the Puerto Rico Solid Waste Management Authority (SWMA), Kankakee County, Illinois, the Connecticut Resources Recovery Authority (CRRRA), the Delaware Solid Waste Management Authority, Charleston County, South Carolina, the Mid-America Regional Council (MARC) Solid Waste Management District in Kansas City, and several other clients as summarized in Table 3 and described below. Currently, ARI is engaged by the Los Angeles County Department of Public Works to provide consulting services for facilitation of development of a conversion technology demonstration facility in Southern California. Work being performed includes detailed evaluation of six conversion technologies and six MRFs that may be suitable for the installation, integration and operation of a conversion technology facility.

As will be noted in our selected project descriptions, our highlighted experience extends well beyond familiarity with design aspects of emerging technologies. We have inspected operational facilities, reviewed environmental performance, and examined detailed financial aspects of project development. This in-depth experience is particularly evident through our recent and ongoing work for the New York City Department of Sanitation and the Economic Development Corporation.

For New York City, ARI has completed a comprehensive evaluation of new and emerging technologies for the management of municipal solid waste. To the best of our knowledge, this is the most recent study of its type and magnitude recently conducted in the United States. The work tasks included: development of an evaluation methodology and evaluation criteria; identification of new and emerging technologies; evaluation of the technologies in accordance with the approved methodology and criteria – considering the need for pre-processing of waste by a materials recycling facility; and preparation of a report of findings. As part of this work, recent studies and procurements in Toronto, Collier County, FL, Puerto Rico, Seattle, WA, Santa Barbara County, CA, the City of Los Angeles and the California Integrated Waste Management Board were reviewed. In addition, to seek the most up to date information from project developers, a Request for Information was issued to more than 100 parties. Technologies evaluated included pyrolysis, gasification, plasma, acid hydrolysis to create ethanol and levulinic acid, anaerobic digestion, and others. The study in New York was completed in September 2004. The full report was made part of the City's 20-Year Solid Waste Management Plan. ARI presented testimony on emerging technologies at a hearing of the City Council Solid Waste Committee in December 2004.

**Table 3**  
**REPRESENTATIVE ARI PROJECT EXPERIENCE**  
**INNOVATIVE TECHNOLOGIES**

Project	Type of Waste*	Feasibility Study/Plan	Environmental Impacts	Economic/Financial Review	Procurement (RFP, Proposal Evaluation, Contract Negotiation)	Thermal (Gasification, Plasma Arc)	Hydrolysis, Waste-to-Ethanol or Levulinic Acid	Anaerobic Digestion/Composting	Recycling/ Materials Recovery
New York City, NY	M	✓	✓	✓	✓	✓	✓	✓	✓
Los Angeles County, CA	M	✓	✓	✓	✓	✓			✓
City & County of Santa Barbara, CA	M	✓	✓	✓	✓		✓	✓	
San Diego, CA/BAS	M	✓	✓	✓		✓	✓	✓	
Sacramento Municipal Utility District, CA	M	✓	✓	✓	✓	✓		✓	
Delaware Solid Waste Management Authority	M	✓	✓	✓		✓	✓	✓	
Taunton, MA	M	✓	✓	✓	✓	✓	✓	✓	✓
Kankakee County, IL	M	✓	✓	✓		✓	✓	✓	
Connecticut Resources Recovery Authority	M	✓	✓	✓					
Charleston, SC	M	✓	✓	✓	✓	✓			✓
Mid-America District, KS	M	✓				✓			
Benson, MN (Fibrowatt)	A	✓	✓						
Island of Puerto Rico	M, I, A, ME	✓	✓	✓	✓	✓			✓
Masada	M	✓	✓				✓		✓
GeneSyst	M	✓	✓	✓			✓		✓
Glens Falls, NY	M, I	✓					✓		
Hudson County, NJ	M, H	✓		✓	✓			✓	✓
West Cook County, IL	M	✓	✓	✓				✓	
Manchester, CT	M, I, H	✓		✓				✓	✓

\* M = Municipal                      A = Animal Waste, Agricultural Waste  
H = Hazardous                      ME = Medical  
I = Industrial

To continue its efforts to evaluate emerging technologies, ARI was retained by New York City for follow-up investigations for comprehensive evaluations of the most advanced of the emerging technologies, including pyrolysis, high-temperature gasification, plasma gasification, wet and dry anaerobic digestion, and hydrolysis. The objective of this follow-on work was to independently verify information provided by technology sponsors and to address technology transfer issues in utilization of the technology in New York City, considering specific waste characteristics, environmental requirements and product markets. Work was completed in March 2007, and the results were presented to City Council in May 2007. The City is in the process of establishing a Task Force for siting a demonstration facility.

Representative project descriptions for emerging solid waste management technologies follow.

- **Los Angeles County, California Department of Public Works**  
*Phase II: Facilitation of Development of a Conversion Technology Demonstration Facility in Southern California, 2006-2008*

ARI is currently engaged by the Los Angeles County Department of Public Works to provide consulting services for facilitation of development of a conversion technology demonstration facility in Southern California. Services being performed include an independent evaluation and verification of the qualifications of six emerging technology suppliers and the capabilities of their technologies, including tours and inspections of reference facilities in the US, Europe, Israel and Japan; an independent evaluation of six MRFs, to determine suitability for installation, integration and operation of one of the emerging technologies; identification and pursuit of funding opportunities for project development; participation in negotiation efforts, and support of public education efforts.

The Phase II report was published in October 2007. ARI has since prepared a Request for Offers for Competitive Evaluation of the Most Advantageous Project(s). ARI will assist in the review of Offers. ARI is also participating in the Public Outreach Program.

- **New York City Economic Development Corporation/Sanitation Department**  
*Review of New and Emerging Solid Waste Management and Recycling Technologies for Solid Waste Plan; Verification and Validation of Technology Sponsor Data, 2003-2007, Phases 1 and 2*

ARI recently completed a study for the New York City Economic Development Corporation and the Department of Sanitation to identify and evaluate new and emerging waste management technologies for municipal solid waste. The objective of the study, made part of the City's solid waste plan, was to ensure that the plan reflected an understanding of the state of new and emerging technologies and approaches for the processing, transport, and disposal of solid waste and recyclables, and that the plan was cognizant of the regulatory and business environment in which these technologies and approaches are evolving.

The study reviewed existing and proposed City waste management plans, identified potential future trends in regulations that may impact the evaluation of new technologies, developed a methodology and evaluation criteria for review of new and emerging technologies, identified new and emerging technologies for review, evaluated the technologies and provided a report of findings. The report described what technologies are available and which technologies may be appropriate for further investigation by the City as it moves forward in its solid waste planning efforts.

As part of this work, recent studies and procurements in Toronto, Collier County, Florida, Puerto Rico, Seattle, Washington, the City of Los Angeles and the California Integrated Waste Management Board, were reviewed. In addition, to seek the most up to date information from project developers, a Request for Information was issued to more than 100 parties. Technologies evaluated included pyrolysis, high-temperature gasification, plasma gasification, acid hydrolysis to create ethanol and levulinic acid, aerobic and anaerobic digestion, and other mechanical and chemical processes. The study in New York was completed in September 2004. The full report was made part of the City's 20-Year Solid Waste Management Plan. ARI presented testimony on emerging technologies at a hearing of the City Council Solid Waste Committee in December 2004.

To continue its efforts to evaluate emerging technologies, ARI was retained by New York City for follow-up investigations for comprehensive evaluations of the most advanced of the emerging technologies, including high-temperature and plasma gasification, pyrolysis, anaerobic digestion and hydrolysis. The objective of this follow-on work was to independently verify information provided by technology sponsors and to address technology transfer issues in utilization of the technology in New York City, considering specific waste characteristics, environmental requirements and product markets. This Phase 2 work included an independent technical review and evaluation, including major system components, site size requirements, mass and energy balances, operating data, products, residue requiring landfill disposal, and technology transfer issues. An independent environmental review and evaluation was also conducted, including air pollutant emissions, water usage, wastewater discharge, product quality, and residue quality. In addition, project economics as estimated by the technology suppliers were summarized and evaluated, and an independent assessment was made of the reasonableness of those economics. A Final Report was issued in March 2007. The City is currently developing an implementation plan for a one or more demonstration facility(ies) (Phase 3 of the project). Work on this third phase of the New York City project is being initiated with a siting study.

- **City and County of Santa Barbara, California**  
*Evaluation and Procurement of Conversion Technologies*

ARI has been retained by the City and County of Santa Barbara, California to evaluate conversion technologies for the management of municipal solid waste and, if determined by the City and County that such a project would be feasible

and desirable, to provide procurement services for a conversion technology facility at the Tajiguas Landfill. Evaluation services include defining project objectives, establishing final screening and evaluation criteria, identifying conversion technologies and collecting and reviewing relevant information, conducting an evaluation of eleven (11) conversion technology suppliers, and preparing a final evaluation report with a recommended shortlist of technology suppliers. As part of this effort, ARI prepared a Request for Information and reviewed the information submittals. ARI will present the findings to the City and County, and will provide guidance in the decision-making process regarding development of a project. Procurement services include developing and issuing a Request for Proposals (RFP) to the final shortlist of technology suppliers and assisting the City and County define the roles and responsibilities of the participating jurisdictions. ARI is responsible for leading strategy meetings with the City and County during the evaluation and procurement process.

- **City of San Diego, California**

*Review of Emerging Technologies and Conventional Waste-to-Energy Technology for the San Diego Long-Term Waste Management Options Strategic Plan*

As part of a team with BAS, ARI is reviewing emerging technologies and conventional waste-to-energy technology for consideration in the City's Long-Term Waste Management Options Strategic Plan. Engineering, environmental and economic issues are being addressed in the review.

- **Sacramento Municipal Utility District, Sacramento, California**

*Evaluation of Conversion Technologies*

ARI is currently conducting a review of conversion technologies to assess the potential to process municipal solid waste. Focus has been applied to a review of those technologies that convert waste to electricity, including gasification, pyrolysis and plasma arc systems. These conversion technologies are being compared to modern waste-to-energy facilities. Engineering, environmental and economic factors are being analyzed in the context of a 500 TPD and a 1,000 TPD facility.

- **Private Electric Utility**

*Evaluation of Conversion Technologies*

ARI is currently engaged by a private electric utility to provide consulting services associated with conversion technologies that process waste, generating electricity and other forms of energy and products. Services include: providing general assistance to evaluate conversion technologies that process municipal solid waste and other waste feedstocks, such as biosolids; conducting evaluations of specific technologies and/or project applications of such technologies; and addressing questions and providing responses as requested.

- **Kankakee County, Illinois**

In Kankakee County, Illinois, just south of Chicago, ARI was engaged to conduct a review of emerging technologies and conventional waste-to-energy technologies to determine if such technologies offer an attractive alternative to landfill disposal of municipal solid waste. The review included a technical evaluation of the reliability and performance of the technologies, environmental impacts, and economics, for a facility size of 400 tons per day. Technologies reviewed included high-temperature and plasma gasification, pyrolysis, anaerobic digestion, hydrolysis and conventional waste-to-energy technology. The results of the study were incorporated into an update to the solid waste plan for the county.

- **Connecticut Resources Recovery Authority (CRRA)**

*Support for Evaluation of Future Use Options for the CRRA System, 2005*

The Connecticut Resources Recovery Authority (CRRA) is a state-wide agency responsible for developing solid waste disposal facilities to serve the needs of municipalities in Connecticut. The CRRA has and continues to emphasize the use of public/private partnerships for development and operation of these facilities. There are four CRRA waste-to-energy facilities, two CRRA MRFs and several landfills that are serving municipal needs in Connecticut.

ARI was requested to evaluate new and emerging technologies-gasification, anaerobic digestion and waste-to-ethanol technologies-as an alternative for future use as part of the CRRA system. The planning level evaluation considered the characteristics of the waste, the status of commercial application of the innovative technologies, potential environmental impacts and benefits when compared to conventional waste-to-energy, and life-cycle project economics. Several technologies were found to meet the CRRA criteria for further consideration, including anaerobic digestion and thermal conversion technologies. The next step is completion of a detailed feasibility study, including detailed review and evaluation of technical, environmental and economic information. Work on this next step is expected to begin in July 2006.

- **Delaware Solid Waste Management Authority**

*Evaluation of New and Emerging Technologies*

ARI is currently engaged in the review of new and innovative technologies to convert municipal solid waste to useful products and to extend the use of an existing landfill. The review is considering thermal, biological, hydrolysis, and chemical and mechanical processing systems.

- **Charleston County, South Carolina**

*Planning and Engineering Services for Integrated Solid Waste Management Plan, Including Innovative Technology Review; Independent Engineer for Operations Monitoring at Waste-to-Energy Plant*

ARI is currently engaged by Charleston County on two assignments: long range planning and engineering services for integrated solid waste management, and operations monitoring of an existing waste-to-energy facility. The County's current solid waste management system uses an integrated approach consisting of recycling, composting, resource recovery, and landfilling. The system includes an 80-tpd material recovery facility, a 22-acre yard waste composting facility, a 644-tpd waste-to-energy facility, a 312-acre landfill, and numerous convenience centers throughout the County for receipt of waste and recyclables.

The County engaged ARI to provide long range planning and engineering services, as part of a proactive approach in addressing possible closure of the existing landfill in 2005 and potential termination of the 20-year Service Agreement for the waste-to-energy facility in 2010. **As part of the planning effort, ARI inspected and assessed each of the County's existing solid waste facilities along with several regional landfills potentially available for use by the County. ARI also identified and evaluated emerging solid waste management and recycling technologies including gasification, waste-to-ethanol, MSW composting and bioreactor landfills. For these emerging technologies ARI presented the distinguishing features of the technology, summarized the commercial status the technology has achieved, and identified potential advantages and disadvantages.**

ARI reviewed current solid waste regulations, identified policy trends that may affect future facilities planning, reviewed existing contract agreements, and developed annual waste generation projections. ARI developed and evaluated a wide range of alternatives for future, long-term management of County waste. The alternatives considered included, in various combinations: (1) continued operation of the waste-to-energy facility; (2) development of a new landfill within the County; (3) construction of a new material recovery facility for increased recycling; and (4) exporting waste out of County for disposal.

ARI developed an interactive computer model to evaluate complex, integrated solid waste management systems, and applied the economic model to a large number of waste management alternatives. The economic model included sensitivity analyses and a ranking of alternatives based on the net present value of annual net costs over a long-range planning period. ARI also assessed several important issues that impact the development of solid waste management facilities including environmental aspects, regulatory requirements, and ownership alternatives. In May 2003, ARI prepared a comprehensive report compiling the results of the planning effort, provided recommendations, and developed an action plan. Currently, ARI is assisting the County with implementation of selected alternatives.

- **Evaluation of IES Pyrolysis Technology (Riverside County, CA) for Application in Barbados**

*Innovative Technology Review, Pyrolysis*

ARI was retained by a private client (considering a commercial development role for a proposed project) to review the technical viability of the IES Advanced Pyrolytic System for potential application for a 500-ton per day waste to energy facility in Barbados. ARI reviewed published data and toured the demonstration facility located in Southern California. Based on available information, ARI independently evaluated the technology for criteria including status of development, reliability, beneficial use of waste and residual waste requiring disposal. ARI prepared a summary of findings, including a description of the technology and identification of technology issues that may present a risk to project financing.

- **Mid-America Regional Council, Kansas City, MO**

*Preparation of Innovative Technology Status Report for Solid Waste Plan Update*

The Mid-America Regional Council (MARC) is a metropolitan planning organization for Greater Kansas City, Missouri/Kansas. ARI recently completed a review of innovative and alternative processing technologies, as part of a status report on integrated solid waste management for MARC. Technologies reviewed included: MSW composting; gasification; waste-to-ethanol; thermal de-polymerization; “reculturing”, an alternative refuse derived fuel processing technology; and mixed waste processing. ARI’s review described each technology, its potential benefits, its commercial status, and economics (if available). ARI also addressed: management options for demolition debris (wood waste, gypsum drywall and asphalt shingles); commercial and industrial food waste; commingled residential plastics; and biosolids.

- **Commonwealth of Puerto Rico**

*Integrated Solid Waste Management Planning, Feasibility Study, Procurement, Including Consideration of Innovative Technologies*

The Commonwealth of Puerto Rico has recently adopted an island-wide Solid Waste Plan for MSW management (Plan). ARI served as leader of a team of technical, financial and legal advisors assisting the Solid Waste Management Authority (SWMA) to plan for, establish the feasibility of, and implement two resource recovery facilities to serve the solid waste management needs of northwest Puerto Rico (Northwest Resource Recovery Facility) and the San Juan metropolitan area. ARI assisted in preparing feasibility studies, the planning, procurement, contract negotiations, EIS preparation and environmental permitting, and implementation of the resource recovery facilities, integrated with an Island-wide recycling program.

In accordance with the Plan, the resource recovery facility was integrated with a recycling program to achieve an overall, 35% recycling rate. Recycling facilities would achieve 32% recycling of waste prior to combustion, with an additional

3% recycled by recovery of ferrous and non-ferrous metal at the resource recovery facility. Also, ash recycling options were evaluated for the facility to minimize the need for landfill disposal and to provide on-island resources such as aggregate for construction.

A unique feature of this project was consideration via a formal procurement process of both conventional and innovative technologies for a large scale project; i.e., a 1800 TPD facility. A comprehensive qualifications review was conducted through a Request for Qualifications. Qualified vendors were then requested to respond to a Request for Proposals (RFP). Detailed technical and financial proposals were reviewed.

During the procurement process, ARI conducted tours of the proposers' reference resource recovery facilities operating in the United States (conventional technologies) and Germany (Thermoselect gasification technology). The purpose of the tours was multifold: to gather information from actual, operating facilities for use in establishing the engineering design basis for the facility being procured for Puerto Rico; and to assess the viability of the technologies and their acceptance by the local communities. Initial tours were conducted in 1999, prior to receipt of proposals. Following these tours, technical, environmental and business information obtained was compiled for each facility visited, and a series of photographs taken at each facility during the inspections was compiled by ARI. Follow-up tours were conducted in the winter of 2000 to observe and verify information presented in the proposals.

- **MASADA Resource Group, LLC, Orange County, New York**  
*Preparation of Beneficial Use Application, EIS Scope and Permit Plan for 700TPD Waste-to-Ethanol Facility*

Masada Resource Group, LLC is developing a facility in Middletown, New York that will convert municipal solid waste and sewage sludge to ethanol using the CES OxyNol process. The process is designed to convert the cellulose present in municipal solid waste to ethanol, which will then be sold as a fuel additive (oxygenator).

ARI assisted Masada in obtaining a beneficial use determination from US EPA to have the agency recognize the beneficial nature of the process and its products. ARI also assisted in developing a permitting plan for the facility in conjunction with New York DEC, and prepared the project notification to prepare an Environmental Impact Statement under the State Environmental Quality Review Act. ARI then assisted in organizing and conducting a public scoping session for the EIS, addressing public questions regarding the project and potential environmental impacts.

- **Glens Falls, New York**  
*Innovative Technology Review, Waste-to-Levulinic Acid*

ARI was retained by a private client (considering a commercial development role) to review the technical viability of the Biofine Process, jointly developed by

Biofine Inc. and New York State Energy Research and Development Authority (NYSERDA). The Biofine Process extracts the cellulose in municipal solid wastes and other wastes and converts it to levulinic acid. Levulinic acid is a chemical intermediate which can be converted directly into a wide range of high value and commodity chemicals such as gasoline extenders and as an ingredient in the production of epoxy resins, solvents, and herbicide and insecticide products. The technology had been demonstrated at the pilot scale at the NREL.

The private client took an active role in staging development of the technology and financed the construction and operation of a large, pilot facility in Glens Falls, New York. ARI also assisted the private client select an EPC contractor to design and construct a commercial facility. The knowledge and experience gained by ARI in evaluating an innovative technology at the pilot stage and assisting in formulating a development plan to achieve a commercial size facility will be particularly helpful in the proposed Evaluation. We have gained first hand knowledge of the difficulties and time requirements necessary to put together a commercial project, obtain financing, and secure the backing of project sponsors.

- **Benson, Minnesota**

*Planning, Engineering and Environmental Permitting Services for 1400 TPD Turkey Litter and Vegetative Biomass Waste-to-Energy Facility*

ARI has provided key environmental and engineering services to support the development of the Fibrominn turkey litter waste-to-energy power plant in Benson, Minnesota. A landmark project, this will be the first poultry-litter-fueled power plant in the United States. The 50-megawatt facility will utilize 1,400 TPD of poultry litter as its primary source of fuel along with other secondary vegetative biomass materials such as alfalfa stems, oat hulls, and distiller grains. With environmental concerns mounting over the excessive land spreading of manures, the Fibrominn biomass power plant will provide the local poultry industry with a reliable alternative for management of turkey litter.

- **GeneSyst International, Canton OH**

*Feasibility Review of Waste-to-Ethanol Facility*

ARI conducted a feasibility review to support financing for the proposed development of a prototype, commercial-scale waste-to-ethanol facility in Canton, Ohio. The patented, innovative, mechanical and chemical process would convert municipal solid waste to ethanol and other marketable products. ARI's feasibility review addressed technical and economic viability, economic outlook, and environmental impacts associated with the proposed facility. ARI prepared a Feasibility Report that included a waste supply analysis, permitting and regulatory review, technology review, cost analysis, and financial analysis. ARI's report provided conclusions and findings of project viability.

- **City of Savannah, Georgia**

*Greenhouse Gas Emissions Estimates, Evaluation of Disposal Options, 2007-2008*

As part of its operations monitoring contract, ARI prepared greenhouse gas emissions estimates comparing site-specific emissions from municipal solid waste landfilling and conventional waste-to-energy activities. The emission estimates were developed using USEPA Greenhouse Gas Inventory methodologies for municipal solid waste management sources. Included in the calculations were avoided impacts of fossil electricity production. Results were communicated to the client for use in public representations regarding costs and benefits of landfilling and conventional waste-to-energy management options.

- **West Cook County, Illinois**

*Recycling, MSW Composting and Waste-to-Energy Technologies for Solid Waste Management Plan*

ARI, in association with another consultant, conducted detailed analyses of recycling, composting, and waste-to-energy options for potential implementation in the West Cook County, Illinois, area. ARI was responsible for assessing the MSW composting and waste-to-energy options. The results of the study were used by the West Cook County Solid Waste Agency to update its Solid Waste Plan and to select a management option for implementation.

For both technologies ARI evaluated: waste quantity and composition; facility size and conceptual designs; system reliability; siting requirements; environmental impacts and permit requirements; potential health risks; economics; financing options and issues; and implementation schedule requirements.

As part of this project, ARI conducted a national survey of MSW composting projects (existing, closed and advanced development stage facilities) to assess the feasibility of implementing this technology in West Cook County.

ARI prepared conceptual designs, 20-year life-cycle cost estimates, and tipping fees for a 500 TPD MSW composting facility based on Simon Tunnels and a 750 TPD (500 TPD MSW – 250 TPD biosolids) MSW co-composting facility based on Eweson Digester Technology (Bedminster).

ARI presented conceptual designs and 20-year tipping fee estimates for two waste-to-energy options: i) developing a new 500 TPD mass-burn, waste-to-energy facility; and ii) contract service with Foster Wheeler's 1600 TPD RDF waste-to-energy facility (under construction at that time) in Robbins, Illinois. ARI also evaluated the impact on waste-to-energy facility tipping fees of removing the Illinois Retail Rate law subsidy.

This was one of the first studies of this type conducted in Illinois after the Supreme Court decision on flow control. Implications of that decision on facility sizing, financing and implementation were reviewed and discussed.

- **Hudson County, New Jersey**

*Integrated Solid Waste Management System, Recycling, Composting, Waste-to-Energy, Landfill*

ARI was retained as General Engineering Consultant to the Hudson County Improvement Authority. The Authority was developing a recycling center, compost facility, 1500-TPD resource recovery facility, and an ash and bypass landfill. The site was located in Kearny, New Jersey, on property once used for a coal tar facility. The site is contaminated and would be cleaned up by the prior owner.

ARI was responsible for many tasks required for waste-to-energy project implementation. These included: negotiating technical issues for the Service Agreement with Ogden Martin (now Covanta), the private service provider; providing technical support (capacity credit, interconnect design) for negotiating the Power Sales Agreement with Public Service Electric and Gas; negotiating technical issues with the former site owner regarding the extent of site clean up; providing technical input for design and operation of the facility, including environmental permitting, equipment specification, facility site plans, utilities requirements and connections, and site access; and preparing project capital and operating and maintenance costs for the tip fee analysis in support of the Authority's filing for a disposal rate with the Board of Public Utilities.

Also, ARI provided numerous compost services including:

- Design and site plan review for a yard waste compost facility for the City of Bayonne.
- Review of MSW composting as a countywide option.

Specifically in regard to MSW composting, ARI performed a feasibility analysis addressing the integration of waste reduction, mixed municipal solid waste (MSW) composting, and source-separated recyclable processing systems. The analysis reviewed the technical and financial feasibility of several composting and recycling systems for each of three scenarios. Detailed information from compost vendors' and ARI's databases was used to develop financial models to predict the cost of each processing system.

Several composting technologies were reviewed, including Daneco, Bedminster, Lundell, Agripost, Dano and "Dutch Tunnels" manufactured by Agrisystems. Two MSW composting technologies were analyzed in detail, Lundell and Daneco. Three facility sizes were reviewed for each technology: 1300 TPD, 1050 TPD and 150 TPD. Sizes were based on waste quantity and characteristics and on achieving different levels of diversion through composting. The technical feasibility of each scenario was reviewed in light of the technology's operating experience with similarly sized facilities.

ARI developed detailed capital and operating and maintenance (O&M) costs for both technologies for all three scenarios. Elements of the capital costs included site development, engineering, equipment purchase and installation, and debt service. Elements of the O&M costs included personnel and utilities. Based on the detailed analyses, ARI developed total per-ton costs to Hudson County for each scenario.

## 2.3 Representative Project Descriptions, Conventional Waste-to-Energy Facilities

Table 4 identifies ARI's project experience with conventional waste-to-energy facilities. Representative project descriptions follow.

- **Tri-County, Minnesota**  
*Waste-to-Energy Feasibility Study*

In association with another consultant, ARI conducted a waste-to-energy feasibility study for a 500-TPD facility to serve the Tri-County Solid Waste Management Commission (Benton, Sherburne and Stearns Counties, MN). ARI completed preliminary evaluations of mass-burn and refuse derived fuel technologies, and guided site evaluations conducted by others. Three technology/site combinations were recommended for further consideration. For these three options, ARI prepared budgetary cost estimates (construction, operation and maintenance), developed a financial model using the cost estimates as input values, and calculated total present value cost and required tip fee for each option. Finally, ARI conducted a number of economic sensitivity analyses to determine the impact on the projected tip fee resulting from changes in key input parameters. ARI also qualitatively addressed the issue of public or private ownership, and the impact should the needs of Tri-County be met by simply allowing an open and free market. ARI prepared an implementation plan and schedule, identifying short-term and long-term actions for project development.

ARI is currently conducting certain short-term project development activities for the Commission, including: assessment of the benefits of integration of the waste-to-energy facility with an existing wastewater treatment plant at the preferred site location; review of waste generation data, flow control, and facility sizing; evaluation of the potential market for sale of electricity from the facility, including discussions with Stearns Electric (Great River Energy) and Xcel Energy for potential sale of electricity under the Minnesota Renewable Energy Legislation; evaluation of potential steam customers; and development of procurement strategy for project development. ARI has participated in several presentations to the Commission to present the results of the feasibility study and project development activities.

- **Redwood County, Minnesota**  
*Feasibility Study and Procurement for a New Waste-to-Energy Facility and Materials Recovery Facility*

ARI has recently initiated a project to assist Redwood County to develop a new waste-to-energy facility to serve a multi-county region of southwest Minnesota. To be located in Lamberton, Minnesota, the project includes a 350-TPD materials recovery facility (MRF) and a 249-TPD waste-to-energy facility. Presently, ARI is conducting a feasibility study for the project – technical, economic, and environmental. The feasibility study will focus on particular waste-to-energy technology (the Barlow technology). Then, ARI will assist the County to negotiate a service contract with the prospective design/build/operate

**Table 4**

<b>ALTERNATIVE RESOURCES, INC. SUMMARY OF WASTE-TO-ENERGY FACILITY EXPERIENCE</b>		
<b>Location</b>	<b>Facility Size/Design</b>	<b>Energy Market</b>
Bridgeport, Connecticut	2250 TPD, Mass Burn	Electricity
Lisbon, Connecticut	700 TPD, Mass Burn	Electricity
New Haven, Connecticut	375 TPD, Mass Burn	Steam
Wallingford, Connecticut	360 TPD, Mass Burn	Electricity
Savannah, Georgia	624 TPD Mass Burn	Steam/Electricity
Robbins, Illinois	1600 TPD Fluid Bed	Electricity
Portland, Maine	500 TPD, Mass Burn	Electricity
Saco/Biddeford, Maine	600 TPD, RDF	Electricity
Boston, Massachusetts	1500 TPD, Mass Burn	Steam/Electricity
Holyoke, Massachusetts	685 TPD, Mass Burn	Electricity
Leominster, Massachusetts	1650 TPD, Mass Burn	Electricity
Lowell, Massachusetts	1500 TPD, Mass Burn	Electricity
Haverhill, Massachusetts	1500 TPD, Mass Burn	Electricity
Millbury, Massachusetts	1500 TPD, Mass Burn	Electricity
Detroit, Michigan	3000 TPD RDF	Steam/Electricity
Jackson County, Michigan	200 TPD	Steam/Electricity
Redwood County (Lamberton), Minnesota	249 TPD Mass Burn	Steam and/or Electricity
Tri-County (St. Cloud), Minnesota	500 TPD Mass Burn	Steam and/or Electricity
Olmsted County, Minnesota	450 TPD Mass Burn	Steam/Electricity
Benson, Minnesota	1400 TPD Mass Burn (Turkey Litter and Agricultural Waste)	Electricity
Pascagoula, Mississippi	150 TPD Mass Burn	Steam
St. Louis, Missouri	600 TPD Mass Burn	Steam
Durham, New Hampshire	150 TPD, Mass Burn	Steam
Mercer County, New Jersey	1450 TPD, Mass Burn	Electricity
Hudson County, New Jersey	1500 TPD, Mass Burn	Electricity
Hempstead, Long Island	1500-2000 TPD, Mass Burn	Electricity
New York City, Brooklyn	3000 TPD Mass Burn	Steam
New York City, other boroughs	1000-3000 TPD Mass Burn, RDF	Electricity
Rochester Gas & Electric	RDF/coal at existing coal fired utility plant	Electricity
Akron, Ohio	1000 TPD RDF	Electricity
Clark County, Ohio	1750 TPD Mass Burn	Steam
Bucks County, Pennsylvania	150 TPD Mass Burn	Steam/Electricity
Erie, Pennsylvania	700 TPD Fluid Bed	Electricity
Philadelphia, Pennsylvania	2250 TPD Mass Burn	Steam/Electricity
Susquehanna, Wyoming Counties, Pennsylvania	525 TPD Fluid Bed	Electricity
Bradford Dyeing Assoc., Rhode Island	300 to 400 TPD, Mass Burn	Steam/Electricity
Charleston, South Carolina	644 TPD Mass Burn	Steam/Electricity
Puerto Rico	Two, 1800 TPD	Electricity

contractor. ARI will also provide advice regarding how to integrate the new waste-to-energy facility with the existing solid waste infrastructure in the multi-county region (collection, recycling and landfills).

- **Puerto Rico Solid Waste Management Authority**  
*Planning and Development of Resource Recovery Facilities*

Puerto Rico has recently adopted an island-wide Solid Waste Plan for municipal solid waste (MSW) management. ARI was retained by the Authority to assist in the planning, procurement, environmental permitting, and implementation of two resource recovery facilities, each 1800-TPD in size, one to serve Northwest Puerto Rico and one to serve the San Juan Metropolitan Area. The facilities included thermal conversion of the waste for production of steam and generation of electricity and recovery of recyclable materials. Recycling of ash and/or components of the ash was also part of the project.

Specific tasks performed by ARI included:

- Waste sampling and analysis programs
- Siting studies
- Facility conceptual design
- Power sale negotiations
- Procurement activities, including preparation of Requests for Qualifications and Requests for Proposals, evaluation of Qualifications Statements and Proposals, and contract negotiations
- Preparation of EIS and permit applications
- Planning and implementation of public information program
- Analysis of ash management, recycling and disposal options
- Analysis of transfer station plan for delivering waste to the waste-to-energy facility

- **St. Thomas and St. Croix, U.S. Virgin Islands**  
*EIS and Permit Preparation for a 150-TPD, Mass-Burn Resource Recovery and Desalination Facility*

ARI reviewed the EIS's and permit applications for two 150-TPD waste-to-energy and desalination facilities for the project developer in preparation for public hearings.

- **Jackson County, Michigan**

- Operations Monitoring and Technical Support for 200TPD Waste-to-Energy Facility*

ARI was recently selected to provide Jackson County with independent monitoring services at its waste-to-energy plant. Services include providing monthly review of pass-through costs, plant efficiency, forced outages, waste quantity and revenues, and energy exports and revenues and preparing monthly operations reports. In addition, annual facility inspections will be conducted, as will an air emissions compliance review, and equipment replacement review. An annual report will be prepared. Also, a review of operating and capital budgets will be performed. Future tasks will include contract negotiations with the private operator and contract negotiations for the sale of energy.

- **Charleston County, South Carolina**

- Independent Engineer for Operations Monitoring at Waste-to-Energy Plant*

Since March 1999, ARI has provided consulting services for operations monitoring of the Charleston Resource Recovery Facility. As independent engineer, ARI provides routine services as well as specialized expertise for unique issues that arise. Specific tasks routinely performed by ARI:

- semi-annual inspections of the facility and preparation of reports for presentation to Charleston County;
- review of monthly operating data, costs, and revenues, and preparation of monthly operations monitoring reports;
- review of annual requirements of the Service Agreement, including calculation of steam price and O&M fee adjustments, and determination of capacity guarantees;
- preparation of an annual report summarizing facility performance and documenting historical trends;
- review of air emissions compliance of the facility, including: witness of performance tests and review of data; review of quarterly emissions reports, and review of maintenance schedules and reports;
- evaluation of equipment replacement, modification, or renovation undertaken by the operator to achieve and maintain compliance with the Clean Air Act Amendments; and
- as needed, provide economic and financial analysis of components of the Service Agreement for the County.

Specialized expertise ARI has provided for the waste-to-energy facility include: independent assessment of the design and costs associated with installation of a carbon injection system at the facility to control mercury emissions; a review

of environmental compliance issues; consideration of the potential impact of a proposed permanent water main easement on the facility site lease; assistance with contract negotiations regarding the higher heating value of waste processed at the facility; and, in conjunction with sale of the facility, issued an opinion letter regarding the experience and capability of the proposed replacement operator.

- **Savannah, Georgia**

- Operations Monitoring Assistance for Waste-to-Energy Facility*

ARI serves the City of Savannah, Georgia as independent engineer for a 624-tpd waste-to-energy facility and landfill. The facility burns municipal solid waste collected from residences and businesses in the City and non-hazardous industrial waste from the County and surrounding areas. As independent engineer, ARI provides routine operations monitoring services as well as specialized expertise for unique issues that arise.

ARI provides operations monitoring of the facility including monthly plant inspections and preparation of a report reviewing operating performance. ARI tracks the amount of waste delivered to the facility, waste bypassed to the landfill, steam generated and sold, and electricity sold. These parameters are summarized and graphed on a monthly basis to monitor facility performance. ARI also reviews plant staffing, plant improvement, preventive maintenance, activity with regulatory agencies, and other issues of importance. ARI observes the annual performance testing and ash residue testing, including review and analysis of analytical data collected during those testing events and reviews and evaluates annual and semi-annual emissions reports.

- **Olmsted County, Minnesota**

- Air Permitting Services for Waste-to-Energy Facility Expansion*

ARI is currently providing key air permitting services for an ongoing expansion project at the County's existing waste-to-energy facility. The 250-TPD expansion project entails the addition of a third, mass-burn unit. ARI has developed preliminary design data needed for the air permitting, including the ultimate and proximate analyses for the solid waste, as well as design values for the flue gas flow rate and temperature. Currently, ARI is preparing the analysis of Best Available Control Technology (BACT) under Federal "PSD" air permitting rules. The focus in this regard is BACT requirements for nitrogen oxides and the key issue is whether Selective Non-Catalytic Reduction (SNCR) will be shown to be cost effective as BACT, or not, for a 250-TPD unit. ARI is also determining the emission rates of all regulated air pollutants for use in air impact modeling, and is developing estimates of toxic air pollutant emissions for use in health risk assessment. Finally, ARI is preparing the Materials Separation Plan and the Siting Analysis that are required for the plan expansion under Federal New Source Performance Standards (NSPS) for municipal waste combustors.

- **New York City, New York**

*Facility Design Specifications/EIS's for Mass Burn and RDF Waste-to-Energy Facilities*

In association with other consultants, ARI has prepared Environmental Impact Statements for four waste-to-energy facilities capable of processing 10,000-TPD of waste. This effort was the next step after the Brooklyn Navy Yard project in the City's implementation program for waste-to-energy plants. Both mass-burn and refuse-derived fuel (RDF) technologies were evaluated.

ARI was responsible for waste-to-energy facility engineering. Since a specific vendor(s) to design, construct, and operate the facility was not selected by the City prior to completion of the EIS's, preliminary facility designs and site layouts were completed by ARI in conjunction with a Vendor Review Panel. This engineering effort included preparation of facility site layouts, mass and energy balances, stack design and exit gas conditions, emissions estimates, and a review of air pollution control measures. Additionally, ARI completed a comprehensive Health Assessment Protocol that has been accepted by the City and State environmental and health agencies.

ARI was also active in the City's public participation program, which included making presentations and responding to questions raised by citizen advisory committees established for each site.

- **Robbins, Illinois**

*RDF System Conceptual Design and Environmental Permitting for 1600-TPD Resource Recovery Facility*

For a private developer (Reading Energy Company), ARI prepared the air quality, solid waste and water permit applications for a proposed 1,600-TPD fluidized bed, waste-to-energy facility. As part of preparing the applications, ARI provided assistance in determining environmental design requirements and provided input regarding plant layout and site access to minimize environmental impacts.

The air permit application included detailed BACT analyses for air pollution control equipment and an ambient air quality impact analysis in accordance with state and federal PSD requirements. ARI responded to agency questions regarding the permit applications and provided expert testimony in two public hearings. ARI also assisted the developer to create and implement a plan for gaining public acceptance of the project. Final permits were granted in early 1993; the facility operated during the 1990's.

ARI prepared a waste composition analysis for facility design and prepared a conceptual design for the RDF front-end system.

- **Clark County, Ohio**  
*Air, Wastewater, Stormwater Permitting for a 1,750-TPD Mass-Burn Waste-to-Energy Facility*

For a private developer, ARI prepared the Federal PSD and State "PTI" air-quality permit applications, including preparation of the top-down BACT analysis, air quality modeling assessment, and inhalation risk assessment. A key issue was the negotiation of BACT/LAER requirements for NO<sub>x</sub> with the regulatory agencies, in light of the Nonattainment Title of the 1990 Clean Air Act. Ohio EPA deemed the submitted applications complete.

ARI also prepared the State stormwater and wastewater permit applications for the project, and coordinated necessary wetlands mapping and soils assessment.

- **Littleton, Massachusetts**  
*Feasibility Study for a 30-TPD, Mass-Burn Incinerator System*

ARI completed a study for the Town of Littleton, Massachusetts, to evaluate the feasibility of a 30-TPD incinerator, including the option of energy recovery. The study provides the town with a comparison of waste disposal at an in-town facility versus transferring waste for disposal outside Littleton.

As part of the study, ARI developed waste estimates using existing and projected population figures and the projected effects of voluntary and mandated recycling programs. Based on these estimates and taking into account environmental regulatory requirements, a system conceptual design was completed, including system sizing and complete mass and energy balances. Site layouts were prepared to evaluate two sites – the existing landfill and a site on property adjacent to the landfill. Air quality impacts were predicted and compared to standards, and potential health effects were evaluated. Residue disposal options were identified, one of which was the possibility of selling residue to a nearby concrete manufacturer. Economic estimates were prepared for capital, operating and maintenance costs, and a life-cycle tip-fee analysis was prepared for an economic comparison of the incinerator with alternative disposal options.

- **Mercer and Atlantic Counties, New Jersey**  
*Permitting for a 1,450-TPD Mass-Burn Waste-to-Energy Facility*

ARI prepared a comprehensive assessment of materials separation as a potential means to control air pollutant emissions from the waste-to-energy facility planned to serve both counties. The study was undertaken in response to US EPA's requirement that materials separation be evaluated as a BACT alternative during PSD permitting of new waste-to-energy facilities. To investigate the potential link between materials separation and stack emissions, the study evaluated: chemical composition data for municipal waste; the

counties' planned recycling programs; emissions test data from municipal waste combustors serving locales where recycling, composting, and battery separation programs take place; and results of field research carried out to measure the effect of materials separation on stack emissions. New Jersey DEPE considered the study findings in setting permit limits for the facility.

- **Portland, Maine**

*Review of Start-Up Plan and Acceptance Test Plan, 500-TPD Mass-Burn, Waste-to-Energy Facility*

ARI reviewed the draft start-up plan and acceptance test plan for the 500-TPD, Portland, Maine waste-to-energy plant. The facility is presently in commercial operation.

- **Braintree, Massachusetts**

*Contract Negotiations and Contract Monitoring, 1,800-TPD Waste-to-Energy Facility and 875-TPD Rail Haul Transfer Station*

ARI, as consultants to the Braintree Finance Committee, assisted the town in contract negotiations with the SEMASS Partnership for agreements to construct and operate a rail haul transfer station in Braintree, and to dispose of the transferred waste at the SEMASS waste-to-energy plant in Rochester, Massachusetts. The town has sold SEMASS an existing incinerator, which was converted to a transfer station. Braintree, as the "host community" for the transfer station, would accept waste from Braintree and other communities in the Boston area. The Town was concerned not only in negotiating an economically attractive waste disposal agreement, but also in protecting the environment of the town.

ARI reviewed the proposed waste disposal, land lease, and purchase and sale agreements; represented the Finance Committee during contract negotiations; and prepared a report to the Finance Committee summarizing key contract principles, Town and SEMASS responsibilities, and agreements to protect the Town. The agreements were accepted by the Braintree Town Meeting by greater than a two-thirds vote.

ARI then served the Town through the Board of Selectmen as contract monitor to ensure that the terms of the agreements were satisfied by the town and SEMASS.

- **Millbury, Massachusetts**

*Independent Engineering Review, Acceptance and Performance Testing, 1500-TPD Mass Burn Waste-to-Energy Facility*

ARI completed a third-party review for refinancing the Millbury Resource Recovery Project. Emphasis was placed on: a review of waste quantity, availability, and pricing; scrubber and electrostatic precipitator performance for

the control of air contaminants; compliance with environmental permit conditions; system reliability and availability; and project economics.

Other activities included review of the acceptance test plan and monitoring of facility performance.

- **Hudson County, New Jersey**

*Engineering and Environmental Services for Implementation of 1500-TPD, Mass-Burn Waste-to-Energy Facility*

ARI was retained in 1988 as General Engineering Consultant to the Hudson County Improvement Authority. The Authority was developing a recycling center, compost facility, 1500-TPD resource recovery facility, and an ash and bypass landfill. The site was located in Kearny, New Jersey on property once used for a coal tar facility. The site was contaminated and was to be cleaned up by the prior owner.

As General Engineering Consultant, ARI has been responsible for many tasks required for waste-to-energy project implementation. These have included: negotiating technical issues for the Service Agreement with Ogden Martin; providing technical support (capacity credit, interconnect design) for negotiating the Power Sales Agreement with Public Service Electric and Gas; negotiating technical issues with the former site owner regarding the extent of site clean up; providing technical input for design and operation of the facility, including environmental permitting, equipment specification, facility site plans, utilities requirements and connections, and site access; and preparing project capital and operating and maintenance costs for the tip fee analysis in support of the Authority's filing for a disposal rate with the Board of Public Utilities.

- **Akron, Ohio**

*Facility Design Review and Inspection for conversion to a 1,000-TPD RDF Waste-to-Energy Facility*

ARI staff evaluated the feasibility of converting the existing straight-steam generation system to a cogeneration facility. Several types of cogeneration technologies were assessed including a topping turbine, an extraction-condensing turbine and a combination of both. Staff also evaluated expansion of the steam-loop to other potential customers, and assessed the existing pricing structure for steam customers. As part of the evaluation, field inspections of the complete facility were conducted, including the MSW receiving and storage areas, and the RDF production system and storage building.

- **St. Lawrence County, New York**  
*Environmental Permitting for 250-TPD Waste-to-Energy Facility*

For a private developer, ARI prepared the air and solid waste permit applications for a proposed mass-burn waste-to-energy facility that would supply steam to a nearby prison complex. ARI represented the developer in permitting negotiations with DEC, and participated in public meetings.

- **Quonset Point, Rhode Island**  
*Review of Environmental Permits for Waste-to-Energy Facility*

ARI conducted an independent review and assessment of the Rhode Island Coastal Resource Management Council (CRMC) permitting process hearing transcripts and exhibits for the proposed Quonset Point Resource Recovery Facility to determine whether the applicant (Rhode Island Solid Waste Management Corporation) had provided CRMC with adequate and sufficient information upon which to base their decision to grant a permit. The assessment focused on two principal areas; modeling of air pollutant deposition; and impact of acidification from SO<sub>2</sub>, NO<sub>x</sub>, and HCl deposits on the Mill Creek Drainage Basin area. Key modeling issues included: selection of appropriate wet and dry deposition models; modeling methodologies; meteorological data; pollution control technology and emissions estimates; pollutant deposition velocities; mass transfer coefficients; and interpretation and analysis of the results. Key biological issues included: individual and additive acidification effects of pollutants on the local ecology; and potential synergistic effects of these acid gases.

ARI reviewed two technical reports and over 2,000 pages of hearing testimony, transcripts, and exhibits, provided CRMC with a detailed report of findings and presented testimony at public hearings.

- **Lowell, Massachusetts**  
*Preparation of Environmental Impact Report, 1500-TPD Mass-Burn, Waste-to-Energy Facility*

ARI prepared the Draft Environmental Impact Report for a 1500-TPD waste-to-energy facility proposed in Lowell, Massachusetts, to accommodate residential and commercial waste and sewage sludge. Key issues addressed in the Draft EIR included air quality, noise, traffic, and public health impacts.

- **Susquehanna/Wyoming Counties, Pennsylvania**  
*Conceptual Design and Environmental Permitting, 525-TPD RDF/FBC Waste-to-Energy Facility*

ARI served as consultant to the project developer of a 525-TPD, RDF-fired fluidized bed waste-to-energy facility. Work activities included: solid waste quantification and characterization; assistance in and engineering design of the

RDF process, the furnace/boiler system, the ash handling system, and the air pollution control system; siting analyses; assistance in contract negotiations for the waste disposal agreement; host community negotiations; energy sales contracts; preparation of environmental permits including a comprehensive health risk assessment; and development and implementation of public education and participation programs. ARI also completed a thorough review of state and federal ash testing requirements and prepared an ash sampling test protocol.

- **Lisbon, Connecticut**

*Environmental Design Review, 700-TPD Waste-to-Energy, Mass Burn Facility*

ARI reviewed the environmental design and operating requirements, potential air emissions, control measures, and regulatory review requirements in Connecticut for a proposed 700-TPD, mass-burn waste-to-energy facility.

The review assisted the project developer to present up-to-date information to the Lisbon Planning and Zoning Commission as they considered a request for siting the facility. ARI prepared and presented testimony at a public hearing of the Planning and Zoning Commission.

- **Leominster, Massachusetts**

*Environmental Permitting Services for a 1650-TPD Mass-Burn Waste-to-Energy Facility*

ARI provided assistance to the developer in obtaining necessary permits and approvals from the City of Leominster for the construction and operation of a 1650-TPD, mass-burn resource recovery facility. Activities included preparation of a site assignment application for the Board of Health and a wetlands filing with the Conservation Commission. Testimony was presented at hearings before the Board of Health and the Conservation Commission.

- **San Bernardino County, California**

*Health Impact Analysis, Waste-to-Energy and Landfill Options*

ARI prepared and presented a report describing the methodology for and the results of recent public health risk analyses for waste-to-energy facilities and municipal landfills. The report was requested by the County Supervisors as they assessed the advantages and disadvantages of various solid waste processing and disposal options.

- **Bushkill, Pennsylvania**

*Assessment of Community Socioeconomic Impacts, 1000-TPD Mass Burn Waste-to-Energy Facility*

ARI prepared an assessment of socioeconomic impacts of the construction and operation of a 1,000-TPD resource recovery facility proposed in Bushkill Township, Pennsylvania. An analysis was made of existing conditions and expected impacts for population, land use, municipal services, municipal fiscal conditions, development goals, local economy, property values and aesthetics. Expert testimony was presented in public hearings.

- **Western Berks County, Pennsylvania**

*Environmental Permitting, 600-TPD, RDF-Fired, Fluidized Bed Waste-to-Energy Project*

ARI assisted the project developer in the development of an air permitting strategy and in the preparation of the air permit application.

- **Holyoke, Massachusetts**

*EIS and Permit Preparation, Public Health Impact Assessment for a 685-TPD, Mass-Burn Waste-to-Energy System*

ARI reviewed the Environmental Impact Report and the air permit application (PSD and Nonattainment Review) for the proposed 685-TPD resource recovery facility in Holyoke, Massachusetts. Potential impacts of dioxin and noncriteria pollutant emissions on public health were assessed. In conducting its review, ARI evaluated project impacts and state guidelines for dioxin and furan emissions. ARI was assisted in its review by Dr. J. Himmelstein, M.D., Associate Director and Chief of Clinical Services of the Department of Family and Community Medicine, University of Massachusetts Medical Center.

Presentations were made at several public meetings and debates, including those before the Board of Alderman, a citizens' opposition group, and the Environmental Defense Fund. The Board of Aldermen and a citywide referendum supported the project.

Subsequently, the site assignment for the proposed project was appealed. ARI provided testimony during the appeal process in regard to emissions estimates and potential health impacts.

- **Erie, Pennsylvania**

*Environmental Design Specifications and Permit Preparation, Waste Composition Study, 700-TPD RDF Fluidized-Bed-Combustor*

ARI provided environmental design and permit preparation services for the Erie multiple-fueled (RDF and tires) waste-to-energy facility. A waste characterization study was conducted to develop a waste composition and ultimate analysis.

ARI scrutinized Federal, Pennsylvania, and local environmental regulations and standards for air emissions, wastewater discharges, solid waste, noise and odor requirements, and specified environmental design requirements for the proposed facility. This review included a detailed analysis of existing and proposed New Source Performance Standards and of Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) control technologies. ARI then reviewed the facility design for conformity to the environmental design specifications. ARI prepared the PSD and Nonattainment Review air permit applications and supported preparation of the solid waste processing facility permit. ARI provided testimony during public hearings on the permits and assisted in responding to numerous questions raised by the state and the public. Permit approvals were granted by the State.

- **Collier County, Florida**

*Environmental Design and Permit Preparation, Health Impact Assessment for an 870-TPD, Multiple Fuels (RDF/Tires/Wood Chips), Fluidized Bed Waste-to-Energy System*

ARI assisted the project developer with the environmental design of the Collier County waste-to-energy facility and with preparation of the air permit application under Florida and federal requirements.

As part of this effort, ARI assisted in developing estimates of air pollutant emissions for the facility; provided advice regarding design and performance guarantees for the air pollution control system; and prepared the required best available control technology (BACT) analysis. ARI analyzed potential health impacts of facility emissions of trace metals and conducted a risk assessment for dioxin emissions.

- **Comparison of Risks from Waste-to-Energy Facilities and Landfills and an Assessment of Host-Community Compensation in Siting Waste-to-Energy Facilities**

In association with another firm, ARI conducted an investigation and prepared a report for the Coalition of Northeastern Governors to identify and compare risks for waste-to-energy facilities and municipal waste landfills. Risks were described for health, safety, and environmental degradation, with emphasis on the potential risk to public health. Techniques to mitigate health risks were

described, together with monitoring techniques and steps that can be taken to ensure that equipment and procedures at a landfill and waste-to-energy waste facility are effective. Geographic risk (i.e., stack emissions and groundwater contamination) was examined so that benefit versus risk to the region and to the host community could be assessed.

In a second project for the Coalition of Northeastern Governors, ARI examined and evaluated host-community benefits being offered by developers of waste-to-energy facilities.

- **Massachusetts, Pennsylvania, New Jersey, New York**  
*Waste Supply Analyses for Proposed Waste-to-Energy Facilities*

For a private resource recovery developer, ARI prepared a comprehensive analysis of waste generation and available disposal capacity for the states of New Jersey, Massachusetts, and portions of Pennsylvania and New York. The objective of the study was to identify potential waste sheds which could support the development of 1500-TPD resource recovery facilities and to estimate the tip fee that could be charged to attract the waste to a merchant facility(s). The analysis was done on a county-by-county basis with the exception of Massachusetts, where the analysis was completed for each municipality in the Commonwealth. Projections were made for a ten-year planning horizon.

## **2.4 Representative Project Descriptions, Materials Recovery Facilities**

Table 5 identifies ARI project experience with Materials Recovery Facilities. Representative project descriptions follow.

- **Millis Consortium, Massachusetts**

*Regional Recycling Feasibility Study, Procurement and Development*

ARI was awarded a contract by the Commonwealth of Massachusetts to conduct a recycling feasibility study for a group of 20 communities (with populations ranging in size from 10,000 to 60,000) in eastern Massachusetts. The study consisted of a review of recycling options. Several options for the design of a MRF were evaluated including those with a high level of mechanical processing and those with hand sorting. Costs and benefits were presented, and impacts of the recycling program on existing waste collection and disposal/hauling contracts were reviewed.

The feasibility study is complete and ARI has prepared a Request for Proposals for Recycling Services (collection, processing, sale). This was the first regional recycling RFP prepared under State Chapter 30B procurement requirements. It was reviewed by the State Inspector General's Office and Department of Labor and Industries and received their approval. The RFP was released to some 50 prospective bidders in March 1991. Vendor responses were evaluated, a contractor selected and contract negotiations were completed.

The RFP process and organizational bylaws adopted by the Millis Consortium communities have been acclaimed as "models" for use by other regions in the State.

ARI assisted the selected contractor in permitting the facility and in facilitating community review of the proposed contract.

- **Lamprey Regional Solid Waste Cooperative, Durham, New Hampshire**

*Regional Solid Waste Processing Facility Feasibility Study*

ARI was retained by the Cooperative to evaluate options for processing the region's solid waste, recovering recyclables, compostables, and a densified refuse derived fuel (dRDF) pellet. The initial plant capacity will be designed to handle 150 tons per day, with expansion to 300 tons per day. The feasibility study included a marketing survey of 50 potential end users who currently combust wood, wood waste, coal, and solid waste in the independent power, utility, pulp and paper, and manufacturing industries, including municipal/public steam plants. The ARI scope of services included:

- A review of solid waste and recyclables generation rates;
- A technical analysis of waste processing and pelletizing technology; Site selection and analysis;

**Table 5**

<b>ALTERNATIVE RESOURCES, INC. PROJECT EXPERIENCE - MATERIALS RECOVERY FACILITIES</b>
<b>Bridgeport Solid Waste Advisory Board, Southwest Connecticut Regional Recycling Operating Committee, 250-TPD Paper and Commingled Intermediate Processing Center (IPC) – Stratford, CT</b> Renegotiation of contract for capital improvements, operation and maintenance and marketing of materials from intermediate processing center.
<b>Millis Consortium - 120 TPD - Paper and Commingled MRF – Massachusetts</b> Feasibility study for various types/levels of processing, system conceptual design, equipment specification, preparation of Request for Proposal, proposal evaluation, contract negotiations.
<b>Housatonic Resource Recovery Authority - 80 TPD - Paper and Commingled IPC – Danbury, Connecticut</b> Feasibility study for various types/levels of processing, facility conceptual design, equipment specification, preparation of Request for Proposal, proposal evaluation, contract negotiations, design review, construction monitoring, and acceptance testing.
<b>Bristol Resource Recovery Facility Operating Committee - 65 TPD - Paper and Commingled IPC - Bristol, Connecticut</b> Feasibility study for various types/levels of processing, facility conceptual design, equipment specification, preparation of Request for Proposal for design, construct, and operational services, bid evaluations.
<b>Partyka Resource Management - 150 TPD - Paper and Commingled System - Chicopee, Massachusetts</b> System conceptual design, equipment specification, and costing.
<b>New Bedford/Dartmouth Solid Waste District - 120 TPD - Paper and Commingled MRF - New Bedford/Dartmouth, Massachusetts</b> Feasibility study for various types/levels of processing, system conceptual design, equipment specification, and costing.
<b>Cape Cod Planning Commission, Regional MRF – Massachusetts</b> Development of business plan for regional MRF to serve Cape Cod Communities.
<b>Central Naugatuck Valley and Housatonic, Connecticut Regions - 160 TPD - Paper and Commingled IPC</b> Feasibility study for various types/levels of processing, facility conceptual design and equipment specification.
<b>South Central Connecticut Region - 170 TPD - Paper and Commingled IPC - New Haven, Connecticut</b> Facility design, equipment specification and costing in support of IPC proposal to South Central Connecticut Region.
<b>Southeastern Connecticut Regional Resource Recovery Authority - Groton, Connecticut</b> Feasibility study to either expand the Groton MRF (the first material recovery facility in the country) or build a new MRF to meet program needs over the next 25 years.
<b>Charleston County MRF Upgrade, South Carolina</b> Evaluation of upgrade to existing MRF to expand recycling operations.
<b>Lamprey Regional Solid Waste Cooperative – 250 TPD – Densified RDF Material Recovery Facility – Durham, New Hampshire</b> Wastashed analysis, preliminary design, feasibility study, end market analysis for DRDF fuel pellets and recyclables, siting, costing and economic analysis.
<b>Monroe County – Paper and Commingled MRF Facility - Pennsylvania</b> Feasibility study and preparation of Request for Proposal, proposal evaluation.
<b>Reading Energy – 300 TPD - Paper and Commingled System - Robbins, Illinois</b> Feasibility Study, system conceptual design, equipment specification, and costing.

- Preparation of a site plan, equipment and building general arrangement;
  - End market surveys for recyclables;
  - End market technical research and cost survey for disposal of the dRDF fuel pellet;
  - Economic analysis including preparation of a capital budget, operations and maintenance budget, market revenues, and financing;
  - Preparation of a permit plan for facility implementation;
  - Development of draft disposal agreements for dRDF fuel pellets and recyclables;
  - Preparation of artist's rendering of proposed facility; and
  - Final Report and presentations.
- **Robbins, Illinois**  
*Feasibility Study for 300-TPD Materials Recycling Facility*

ARI developed conceptual designs for a 300-TPD Materials Recycling Facility (MRF) to complement a proposed waste-to-energy plant.

The study included the following tasks:

- Quantification of amount of recyclable materials
  - Market survey for recycled materials
  - Conceptual design and site layout
  - Preparation of facility capital and operation and maintenance cost estimates
  - Collection cost analyses
- **Cape Cod, Massachusetts**  
*Development of Business Plan for Cape Cod MRF*

Under contract to DEP, ARI conducted an assessment of the economic feasibility of constructing and operating a regional MRF for the Cape Cod communities. Specifically the study included: waste quantification and characterization; an analysis of process system options; preparation of estimates of building and site costs; an analysis of recyclable material markets, revenues and transportation costs; estimates of construction, operating and maintenance and life-cycle costs for each processing option; and development of an implementation plan for recommended facilities. Extensive interaction with the Cape Cod Planning Commission and Cape communities ensued through a process of public review and meetings.

- **Council of Governments, Central Naugatuck Valley and the Housatonic Valley Resource Recovery Authority, Connecticut**  
*Regional Recycling/Composting Program Preliminary Design, IPC Procurement, Construction Monitoring, Acceptance Testing*

The 20 participating communities are a mixture of urban, suburban, and rural municipalities. ARI developed plans for a high-level Intermediate Processing Center (IPC). Preliminary program design activities have included the following:

- Analyzing and recommending a mix of facilities
- Development of a conceptual design for an IPC
- Facility site analysis
- Integration of municipal collection systems into a regional approach
- Development of a plan for recyclables not handled by an IPC
- Identification of a management entity for the regional program
- Development of capital and O&M cost estimates
- Development of a program budget and master schedule

In addition, ARI prepared an RFP to construct an IPC to receive, process and market recyclables. Proposals were received and evaluated. Contract negotiations were successfully completed. Further activities included facility design review, construction monitoring, and acceptance testing.

- **Bristol Resource Recovery Facility Operating Committee, Connecticut**  
*Regional Recycling/Composting Program Preliminary Design and IPC Procurement*

ARI was awarded a contract to provide preliminary program design for a regional recycling program to serve a group of 11 communities in the Bristol, Connecticut area. The recycling program will include: glass and metal food containers, newsprint, white office paper, corrugated cardboard, scrap metal, storage batteries, waste oil and yard waste (leaves). Project tasks have included:

- Analyzing amounts of materials to be recycled
- Analyzing processing needs
- Evaluation of facility options; e.g. an IPC facility providing a low, moderate or high level of processing, a materials marshalling yard, or direct transport of materials to markets
- Development of a functional design for a materials recycling facility and compost facilities
- Site selection
- Design of the collection system

- Defining regional and local responsibilities
  - Development of a Vendor RFP and evaluating submittals: RFP was posted 3/15/90; submittals made 5/21/90
  - Estimating regional and municipal operating costs
  - Development of a program budget and master schedule
- **Regional Waste Systems (RWS), Portland, Maine**  
*Feasibility Analysis, Detailed Design and Implementation for a 500-TPD Waste Baling and 80 TPD Material Recycling Facility*

The project included evaluation of upgrading an existing 15-year old waste transfer station on the RWS waste-to-energy site, replacing the old three ram baler with a new two ram, 300 or 500-TPD baler for bulky waste bypass, upgrading the existing metal pan feed conveyor, and upgrading the RWS recycling facility to a state-of-the-art 80-TPD MRF. ARI was retained to:

- Estimate the quantities and type of recyclable materials
- Review existing facility designs
- Determine upgrade options for both one baler to handle bypass wastes and recyclables, and two baler options
- Evaluate the equipment needs for the MRF to process both commingled recyclables and wastepaper including ONP and OCC
- Define building structural, mechanical, ventilation, plumbing, and site work upgrades, and new loading dock designs
- Estimate capital, operation, and maintenance costs for each option
- Develop a final report for the feasibility study

ARI was also retained to continue the project through implementation. Tasks included:

- Preparing detailed equipment specifications for:
  - recyclable baler
  - MSW baler and bale indexer
  - all necessary chute work and conveyors (new and upgraded)
  - recycling sorting system
  - removal and salvage of the existing baler (275 dead weight tons)
  - support building design modifications
- Assistance in equipment procurement and vendor proposal evaluations
- Review of shop drawings
- Review of equipment installation and acceptance test results

- **SWEROC, Stratford, Connecticut**  
*Renegotiation of Operating Contract for IPC*

Representing SWEROC, ARI assisted in the renegotiation of the operating contract with FCR. ARI reviewed similar IPC contracts, identified options for modifying the contract to reduce costs and risk to the communities, assisted in contract negotiation meetings with FCR, and reviewed proposed contract language. ARI also participated in presenting contract options to SWEROC for consideration and approval.

- **Monroe County, Pennsylvania**  
*Recycling Program Development and Procurement*

Monroe County is a predominantly rural county in northeastern Pennsylvania, including communities with populations ranging in size from less than 1,000 to 10,000. Under PA Act 101, the County is responsible for developing and implementing a plan to recycle 25% of its municipal waste. ARI was retained to:

- Estimate quantities and types of potentially recyclable materials
- Review existing County recycling programs
- Review the County's waste disposal practices
- Determine the County's recycling program options and select options for detailed evaluation
- Define operational requirements for each selected option
- Identify recycling program administrative requirements
- Develop a public information and education program
- Perform an economic analysis of selected options
- Develop an implementation schedule
- Determine the availability of State funding assistance for program planning and implementation (including procurement)
- Prepare draft and final reports

More recently, ARI prepared a Request for Proposals for private parties to provide countywide recycling services. ARI assisted the County in proposal evaluation and contract negotiation.

- **Greater New Bedford Regional Refuse Management District, Massachusetts**  
*Regional Recycling Program*

ARI conducted a recycling feasibility study and prepared a recycling implementation plan for New Bedford and Dartmouth, MA. Specific tasks included:

- Evaluation of existing data on waste generation and composition, waste collection, and disposal practices
- Conducting a comprehensive market survey for sale of recyclables
- Evaluation of the economics of developing a materials recovery facility
- Evaluation of a marketing cooperative and participating in the SEMASS materials recovery facility
- Evaluation of collection systems
- Evaluating a fee system for waste disposal which would encourage recycling

- **Southeastern Connecticut Regional Recovery Authority, Groton, Connecticut**  
*Material Recycling Facility (MRF) Feasibility Study*

ARI conducted a feasibility study to determine the technical and economic feasibility of either expanding the existing Groton MRF, building a new MRF in the region, or a combination of in-region and out-of-region alternatives. The region includes 300,000 people.

- **Bay State Cubing and Recycling, Massachusetts**  
*Beneficial Use Determination*

ARI is assisting Bay State Cubing and Recycling, a private recycling company located in Russell, Massachusetts to obtain a Beneficial Use Determination for production of fuel cubes from paper scrap. The company manufactures various recycled paper products by obtaining pre-consumer paper scrap obtained from local paper mills. The scrap paper is polymer coated and currently disposed by the mills in landfills or incinerators. The polymer coating prevents the paper from being re-pulped. ARI successfully obtained a similar BUD for The Paper People Company (now International Paper Products Company) in 1998.

## **2.5 Economic and Financial Services**

ARI is a recognized leader in providing management, engineering, environmental, and economic and financial services for major infrastructure projects, focusing on water, wastewater, solid waste and alternative energy. ARI is one of the few technical consulting firms that also offers significant expertise in the economic and financial analyses and structuring required to bring a project to fruition.

Our services couple the technical expertise to the economic and financial expertise required to implement infrastructure projects, and are designed to enable clients to efficiently plan, procure, finance, manage and operate capital projects. This expertise is highlighted in many of the representative solid waste project descriptions previously presented, including economic and financial analyses associated with emerging technology projects.

Economic and financial feasibility services ARI provides include:

- Economic and financial feasibility studies;
- Strategic planning;
- Rate and fee analysis;
- Procurement and negotiations;
- Third-party reviews for financing;
- Financing assistance; and
- Assistance in setting and negotiating host community fees.

### **3.0 ARI REFERENCES**

#### **New York City, New York**

*Review and Development of New and Emerging Technologies*

Ms. Venetia Lannon, Vice President  
New York City Economic Development Corporation  
110 William Street, 4<sup>th</sup> Floor  
New York, New York 10038  
Phone: 212-312-4229  
Email: [vlannon@nycedc.com](mailto:vlannon@nycedc.com)

#### **Los Angeles County, California**

*Facilitation of Development of a Conversion Technology  
Demonstration Facility in Southern California*

Mr. Coby J. Skye, P.E., Associate Civil Eng.  
Environmental Programs Division  
County of Los Angeles Department of Public Works  
900 South Fremont Avenue, Annex 3rd Floor  
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Mr. Paul Alva  
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#### **City and County of Santa Barbara, California**

Mr. Carlyle Johnston, Senior Program Specialist  
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Mr. Mark Schleich, Deputy Director  
Resource Recovery & Waste Management Division  
County of Santa Barbara Public Works Department  
130 East Victoria Street, Suite 100  
Santa Barbara, CA 93101  
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**Connecticut Resources Recovery Authority, Hartford, Connecticut**

*Review of New and Emerging Solid Waste Processing Technologies*

Ms. Virginia Raymond, Senior Analyst  
Connecticut Resources Recovery Authority  
100 Constitution Plaza  
Hartford, CT 06103-1722  
Phone: 860-757-7730  
Email: [vraymond@crra.org](mailto:vraymond@crra.org)

**Charleston County, South Carolina**

*Solid Waste Plan, Review of Innovative Technologies*

Mr. Richard Field, Assistant Director  
County of Charleston  
Department of Solid Waste  
13 Romney Street  
Charleston, SC 29403  
Phone: (843) 720-7111  
E-mail: [rfield@charlestoncounty.org](mailto:rfield@charlestoncounty.org)

#### **4.0 BIOGRAPHIES OF KEY PROFESSIONAL STAFF**

Biographies of professional staff are provided for:

- James J. Binder, P.E., Principal and Senior Project Manager
- Susan M. Higgins, P.E., Director of Solid Waste Services, Project Engineer
- James M. Osborn, P.E., President and Director of Environmental Services
- David Mackenzie, Director of Economics and Finance
- Kathleen A. Luvisi, P.E., Senior Civil Engineer
- Lynn Santos, P.E., Consulting Associate

## JAMES J. BINDER

During the past 35 years, Mr. Binder has been active nationwide on more than 100 solid waste, water, wastewater, and sewage-sludge projects for cities as large as New York and with populations less than 1,000. Municipal solid waste projects have included recycling, materials recovery, waste-to-energy, gasification, anaerobic digestion, waste-to-ethanol, and landfill facilities. Activities have included feasibility studies, permitting, procurement, contract negotiations, and contract monitoring. Mr. Binder specializes in project procurement, contract negotiation and implementation for projects developed using public/private partnerships.

### Professional Experience

- Project Manager for evaluation of conversion technologies, Sacramento Municipal Utility District, California.
- Project Director for evaluation of conversion technologies and procurement for conversion technology facility to be constructed at the Tajiguas Landfill for City and County of Santa Barbara, California.
- Project Director for facilitation of development of a conversion technology demonstration facility in Southern California, for Los Angeles County Department of Public Works.
- Project Director for review of emerging technologies and conventional municipal waste-to-energy technology for City of San Diego Long-Term Waste Management Options Strategic Plan. Subcontractor to BAS.
- Review of new and emerging solid waste management technologies – gasification, plasma, hydrolysis and anaerobic digestion – for inclusion in solid waste plan for New York City.
- Preparation of planning level evaluation of gasification, anaerobic digestion, and waste to ethanol technologies as an alternative to replace existing conventional waste-to-energy facility in Connecticut.
- Review of new and emerging technologies (gasification, plasma, hydrolysis, and anaerobic digestion) and conventional waste-to-energy technology for solid waste plan update, Kankakee County, IL.
- Technology review of emerging solid waste processing technologies for the Mid-America Regional Council Solid Waste Management District, Kansas City.
- Development of two 1,800-TPD resource recovery facilities in Puerto Rico for the Solid Waste Management Authority. Activities included waste characterization, feasibility studies, siting studies, environmental assessments, power sale negotiations, procurement and contract negotiations. Conventional waste-to-energy, gasification and plasma arc technologies considered.
- Preparation of long-range planning services for Charleston County, SC, including review of new and emerging waste technologies.
- Preparation of third party engineering report for refinance of Millbury, Massachusetts 1500-TPD waste-to-energy facility.
- Preparation of concept design and DEISs for four waste-to-energy facilities proposed by Department of Sanitation for New York City.
- Review and audit of waste disposal contracts, operations and maintenance practices and costs for recycling and waste-to-energy facilities serving the Committees of Greater Bridgeport Solid Waste Advisory Board in southwest Connecticut. Preparation of report of findings, including recommendations to reduce costs.
- Permitting for 1500-TPD facility proposed by Ogden Martin (Covanta) for Clark County, Ohio.
- Project manager for contract negotiations and contract monitoring for Braintree, Massachusetts for sale/lease of transfer facility to private contractor and municipal waste disposal services at SEMASS waste-to-energy facility.
- Analysis of solid waste management alternatives, including composting, co-composting, and waste-to-energy facilities, for West Cook County, Illinois.
- Feasibility and procurement for private services for a 21 community, regional recycling program, including development of an intermediate processing center, Millis Consortium, Massachusetts. Prepared first 30(B) procurement for a private recycling facility in Massachusetts.
- Development of regional recycling program for Greater New Bedford Regional Refuse Management District.
- Developed and implemented a solid waste management plan for a 100-200-TPD waste shed, Central Bucks County, PA. Plan included curbside recycling of newspaper, glass and aluminum.
- Health impact analysis for waste-to-energy and landfill options, San Bernardino County, California



### James J. Binder, P.E. Principal

### Education

M.S. Major: Mechanical Engineering, Minor: Environmental Engineering, Northeastern University 1974

B.S. Mechanical Engineering, Northeastern University 1969

### Years of Experience 35

### Registration & Certification

Registered Professional Engineer in Massachusetts, Connecticut, New York, Pennsylvania, Ohio, Indiana, Illinois and South Carolina

### Affiliations

American Society of Mechanical Engineers, Solid Waste Processing Division

Past Chairman of the ASME Ready Response Committee on Dioxin Emissions from Municipal Waste to Energy Facilities

Solid Waste Association of North America

Massachusetts DEP Solid Waste Advisory Committee

Design Build Institute of America

Southern California Waste Management Forum

## SUSAN M. HIGGINS

Ms. Higgins is a Senior Project Engineer at ARI specializing in solid waste management. She has diverse, nation-wide experience with all solid waste management systems, including traditional landfilling, resource recovery, recycling, composting, and emerging conversion technologies. Her extensive experience encompasses strategic planning, feasibility studies, design, permitting, procurement, contract negotiations, and operations monitoring.

### Selected Professional Experience

- Senior Project Engineer for review of conversion technologies, Sacramento Municipal Utility District, California.
- Project Manager for evaluation of conversion technologies and procurement for conversion technology facility to be constructed at the Tajiguas Landfill for the City and County of Santa Barbara.
- Project Manager for facilitation of development of a conversion technology demonstration facility in Southern California, for Los Angeles County Department of Public Works.
- Project Manager for Review of emerging technologies and conventional municipal waste-to-energy technology for City of San Diego Long-Term Waste Management Options Strategic Plan. Subcontractor to BAS.
- Conducted an independent technology review of the IES Advanced Pyrolytic Waste Conversion System (Riverside County, CA), for potential application for a 500-TPD waste-to-energy facility in Barbados.
- Project Manager for review of new and emerging waste management technologies for inclusion in solid waste plan in New York City.
- Project manager for review of emerging technologies and conventional waste-to-energy technologies for Kankakee County, IL.
- Conducted a technology review of emerging solid waste processing technologies for the Kansas City Mid-America Regional Council Solid Waste Management District.
- Conducted comprehensive engineering and long-range planning services for the County of Charleston, South Carolina, including recycling, composting, waste-to-energy, landfilling and transfer station operations and review of new and innovative waste management technologies.
- Assisted with feasibility studies and siting studies, and provided engineering and contract assistance for procurement of two waste-to-energy facilities for the Solid Waste Management Authority of Puerto Rico. Reviewed and evaluated technical proposals, including innovative waste-to-energy technologies for gasification and traditional waste-to-energy technologies; toured reference facilities; provided technical expertise for contract development and negotiation.
- Providing independent engineering and operations monitoring services for a 12-MW, 644-TPD waste-to-energy facility in Charleston, South Carolina, including semiannual inspections of the facility, review and analysis of monthly and annual operating and financial data, oversight of environmental and regulatory compliance issues, and performance assessments.
- Providing independent engineering and operations monitoring services for a 4-MW, 624-TPD waste-to-energy facility in Savannah, Georgia, including facility inspections and performance assessments.
- Providing operations monitoring services for a 200-TPD waste-to-energy facility for Jackson County, Michigan
- Project Manager for independent review of feasibility study for proposed waste-to-energy facility in Redwood County, Minnesota.
- Conducted a feasibility study for a 500-TPD waste-to-energy facility for the Tri-County Solid Waste Management Commission (Stearns, Benton and Sherburne Counties, Minnesota).
- Coordinated a Tier 2 determination of the concentration of non-methane organic compounds (NMOC) at the City Landfill in Savannah, Georgia.



**Susan M. Higgins, P.E.**  
**Senior Project Engineer**

### Education

M.S. Civil Engineering/Hazardous Materials Management, Tufts University, 1993

B.S. Engineering Physics, University of Maine, 1987

### Registration & Certification

Registered Professional Engineer - Maine

### Years of Experience

20

## JAMES M. OSBORN

Mr. Osborn is a Principal of ARI. He has more than 35 years of national experience with solid waste management projects. His experience includes solid waste planning, procurement, contract negotiations, power sale negotiations, third-party reviews for project financings and contract monitoring.

### Selected Professional Experience

- Serving as principal for preparation of a solid waste management options study to evaluate advanced conversion technologies for the Delaware Solid Waste Authority's Southern Solid Waste Management Center.
- Serving as project manager for preliminary development services, including conceptual design, for a 25-MW biomass gasification plant (to be fueled with 1,000 TPD of wood waste and 340 TPD of chicken manure) in Bozrah, Connecticut.
- Serving as principal for the evaluation of advanced conversion technologies for a major investor-owned utility in California (confidential client).
- Serving as principal for evaluation of advanced conversion technologies for the St. Paul Port Authority (Minnesota), including a technology overview presentation for application at the Rock-Tenn Energy Center Project.
- Prepared an evaluation of Integrated Environmental Technologies, LLC Plasma Enhanced Melter and associated systems for Energy Capital Partners. Also prepared preliminary evaluation of SenreQ, LLC Waste Gasification/Energy Recovery Systems.
- Served as project manager for an independent technology review of the IES Advanced Pyrolytic Waste Conversion System (Riverside County, CA), for potential application for a 500-TPD waste-to-energy facility in Barbados.
- Served as project manager for feasibility studies, siting studies, and procurement for two resource recovery facilities for the Solid Waste Management Authority of Puerto Rico. Procurement included evaluation of conventional and gasification technologies.
- Served as project manager for preparation of a comprehensive long-range solid waste management plan for Charleston County, South Carolina. The plan included evaluation of new and emerging waste management technologies.
- Obtained Beneficial Use Determination for Bay State Cubing & Recycling, LLC for polymer coated paper. Conducted test burn oversight for combustion of fuel cubes manufactured from this pre-consumer paper mill scrap material.
- Provided consulting services for conceptual design and permitting of the 55-MW biomass-fired Fibrominn Power Plant in Benson, Minnesota.
- Providing independent engineering and operations monitoring services for a 12-MW, 644-TPD waste-to-energy facility in Charleston, South Carolina, including semiannual inspections of the facility.
- Providing independent engineering and operations monitoring services for a 4-MW, 624-TPD waste-to-energy facility in Savannah, Georgia, including monthly facility inspections and performance assessments.
- Providing operations monitoring services for a 3.7-MW, 200-TPD waste-to-energy facility for Jackson County, Michigan.



### James M. Osborn, P.E. Principal

#### Education

Mechanical Engineering  
Coursework, Illinois Institute of  
Technology and Northwestern  
University 1977-1982

M.S. Environmental Science, Drexel  
University 1973

B.A. Biology, Clarion State College  
1971

#### Registration & Certifications

Registered Professional Engineer

#### Years of Experience

35

#### Affiliations

Northeast Public Power Association

#### Other Professional Experience

Senior Project Manager, Associate  
Metcalf & Eddy, Inc. (1985 – 1999)  
Wakefield, MA

Supervisor, Project Analysis Section  
Sargent & Lundy (1972 – 1985)  
Chicago, IL

Mr. Mackenzie is Director of Economics and Finance. He is responsible for all economic analyses and financial advisory and planning services provided by the firm. He has over 35 years experience in the planning, economic evaluation, and financing of solid waste, wastewater, and water infrastructure projects, in both the public and private sectors. He is a frequent speaker, writer and trainer on infrastructure finance and management issues, including acting as a contributing author of *The Privatization Book* (one of the first comprehensive guides to the privatization of utility infrastructure). His extensive consulting experience encompasses life-cycle economics analysis, financial advisory, feasibility study and options analysis, procurement management, institutional design and structuring, as well as revenue analysis and risk allocation.

### Selected Project Experience

- Lead Project Economist for evaluation of conversion technologies and procurement for conversion technology facility to be constructed at the Tajiguas Landfill for the City and County of Santa Barbara.
- Lead Project Economist for facilitation of development of a conversion technology demonstration facility in Southern California, for Los Angeles County Department of Public Works.
- Lead for economic review of emerging technologies and conventional municipal waste-to-energy technology for City of San Diego Long-Term Waste Management Options Strategic Plan. Subcontractor to BAS.
- Provided review of economic aspects of new and emerging waste management technologies for New York City solid waste plan, including review of financial resources of potential project sponsor companies.
- Economic analysis of gasification, anaerobic digestion and waste-to-ethanol technologies for the Connecticut Resources Recovery Authority.
- Provided economic review of new and emerging technologies and conventional waste-to-energy technologies for update to solid waste plan in Kankakee County, IL.
- Developed life-cycle economic model for economic evaluation of solid waste management alternatives (waste-to-energy, landfill, transfer station) for solid waste plan for Charleston County, South Carolina
- Participated on the consulting team that evaluated proposals for an 1,800 TPD mass burning plant (Puerto Rico): financial model review, peer review of basic financing assumptions, cash flow/tipping fee analyses.
- Served as underwriter to the Palm Beach County, FL Solid Waste Authority for the financing of a \$45 million landfill, one of the first solid waste financings that secured bond insurance in the absence of explicit waste flow control. Served as co-managing underwriting for a resource recovery financing for Tampa, FL.
- Served as Financial Advisor on solid-waste resource recovery facilities development for Huntington, NY, Lubbock, TX, Bristol, CT, Commerce, CA, and York County, PA, Pittsburgh, PA.
- Provided economic analyses and advisory services to support contract negotiations for privatized operations and capital improvements at the Borough of Naugatuck, CT, sludge incinerator and treatment plant. Now overseeing investment banker activities and financial structuring.
- Managed the procurement of biosolids disposal/reuse services for the Narragansett Bay Commission: RFQ/RFP preparation, procurement management, proposal evaluation, contract negotiation.
- Served as a key participant in the refinancing of Baltimore's privatized biosolids composting facility, to fund capital improvements and convert variable rate debt to fixed rate.
- Negotiated contracts and the financing plan for a \$60 million biosolids reuse plant in New York City, designed to produce material for landfill cover and hazardous site remediation projects.
- Formulated a bankruptcy work-out strategy for third-party-owned medical waste incinerator (Bronx, NY), including restructuring and extension of existing debt, securing new contract operations arrangement, structuring payment of creditors and negotiating forbearance on LC calls.



### David Mackenzie Director, Economics and Finance

### Education

M.P.A. – University of New Hampshire (1971)  
B.S. – Boston University (1967)

### Years of Experience

35

## KATHLEEN A. LUVISI

Ms. Luvisi has 15 years of experience on a variety of environmental projects, including solid waste, water, and wastewater projects.

### Professional Experience

- Review of engineering and financial aspects of anaerobic digestion technology for new and emerging technology review for New York City solid waste plan.
- Review of emerging and financial aspects of anaerobic digestion technology for update to solid waste plan, Kankakee County, IL.
- Review of a Net Present Value (NPV) analysis comparing two sewer alternatives: the rehabilitation of an existing sewage pump station, or the replacement of the pump station with a gravity sewer. Reviewed the discount rate, the project term, and the assumptions, which were used in the NPV financial analysis.
- Assisted in the preparation of a bond feasibility study for Massachusetts Water Resources Authority. The goal of the study was to assist in the issuance of utility bonds for the Authority. Reports were reviewed and information about planned capital improvements was summarized. Wastewater and waterworks facilities were inspected to gather information about each facility's condition and proposed improvements.
- Prepared a Life Cycle Cost Analysis (LCCA) for a capital improvement for the Massachusetts Water Resources Authority. The LCCA determined the equivalent annual cost for the capital improvement, taking into consideration the initial cost, design life, and annual operation and maintenance costs.
- Managed the planning effort for the regional authority for the purchase of an enterprise management system. The system allowed the authority to track their equipment inventory and to maintain computerized records of preventive maintenance and warranty repair.
- Assisted a municipality in the lease-purchase of sewer maintenance equipment. Prepared financial analyses of the price quotes from three lease-finance companies. Compared the financial proposals, and recommended the most advantageous lease finance arrangement to the municipality.
- Coordinated a cross-functional team in the execution of the final process and civil aspects of the Deer Island Wastewater Treatment Plant in Boston.
- Assisted in the wastewater treatment plant upgrade for South Essex Sewerage District. Responsibilities included review of the mechanical drawings, verifying equipment sizing and placement, coordination among function groups, revising specifications, and interaction with equipment vendors.
- Forecasted increases in wastewater flows for a regional wastewater authority, using a 20-year forecasting horizon based on population projections and regional planning data for 12 communities. Results of the forecasting were used in the authority's strategic planning.



**Kathleen A. Luvisi, P.E., MBA**  
**Senior Engineer**

### Education

MS Environmental Engineering,  
Syracuse University, 1988  
BS Civil Engineering, Tufts  
University 1984  
MBA Simmons Graduate School  
of Management, 2001

### Registration

Registered Professional Engineer:  
Massachusetts

### Years of Experience

15

### Affiliations

American Society of Civil  
Engineers  
Water Environment Federation  
New England Water Environment  
Federation  
Society of Women Engineers  
Women in Technology  
International

## LYNNE P. SANTOS

Ms. Santos is a consulting associate for ARI. Ms. Santos is a chemical engineer with expertise in both air quality engineering and air dispersion modeling. The air quality engineering issues she addresses are air emissions estimates and Best Available Control Technology (BACT) assessments. Ms. Santos is also an experienced air quality modeler. Her master's thesis focused on turbulence and dispersion modeling in the atmosphere. She has applied EPA-approved air quality models for numerous permit applications and studies and has significant air quality model development experience. With funding provided by the Electric Power Research Institute (EPRI), she developed a photochemical puff model that would predict the formation of ozone and fine particles downwind from power plants, SCICHEM. She has presented modeling results at national meetings. Ms. Santos has been involved in the permitting and compliance support of 20 power plants that utilize a variety of fuels including coal, natural gas, oil and biomass fuels.

### Representative Ambient Air Impacts Modeling Experience

- Performed air dispersion modeling for natural gas-fired turbines using EPA-approved model, ISC. Modeling analyses were included in the construction permits for the following energy facilities: Enron Deerfield Energy Center, Deerfield Beach, FL; Enron Midway Energy Center, Fort Pierce, FL and Duke, Attala County, MS.
- Performed cooling tower modeling using SACTI for the following power plants: Plainfield Renewable Energy, Plainfield, CT; Watertown Renewable Power, Watertown, CT; and AES Sparrows Point LNG Project, Sparrows Point, MD.
- Performed SCIPUFF and ISC modeling for odor and carcinogen emissions from the Hanford Waste site in Washington State. Validated the safety of ducting emissions from underground storage tanks to a single stack located away from the worker areas so that workers would no longer need to use a self-contained breathing apparatus (SCBA).
- Performed AERMOD modeling for the following emission sources: Concord Hospital, Concord, NH; National Petrochemicals, Yanbu, Saudi Arabia; Alatoun Steel Complex, Yanbu, Saudi Arabia and confidential Integrated Gasification Combined Cycle (IGGC) power plant in Maine.
- Performed screening modeling using SCREEN3 for the following sources: Millipore, Bedford, MA and Fiber Tech VA, Waynesboro, VA.
- Extended a puff dispersion model, SCIPUFF, to include gas and aqueous phase chemistry and aerosol thermodynamics. Incorporated the model as a plume-in-grid in photochemical modeling systems. Validated using ozone measurements from the Cumberland power plant in Nashville, TN. Funding provided by EPRI.
- Funded by EPRI to perform modeling with both CALPUFF and SCICHEM for a hypothetical source in South Carolina in order to compare the treatment of photochemistry in each of the models. Results were presented at the AWMA specialty conference in Denver, April 2006.



### Lynne P. Santos, P.E. Consulting Associate

#### Education

M.S., Chemical Engineering,  
University of Kentucky, 1994

B.S., Chemical Engineering,  
University of New Hampshire,  
1992

#### Registration & Certifications

Board Certifications:

Registered Professional Engineer  
(Environmental, MA No. 47225)

#### Years of Experience

13

#### Affiliations

American Institute of Chemical  
Engineers  
Air and Waste Management  
Association