

# Compliance Assurance & Pollution Prevention at Argonne National Laboratory-East (ANL-E)-Process and Operations

Mark A. Kamiya  
 Argonne National Laboratory  
 9700 South Cass Avenue  
 Argonne, IL 60439

Keith Trychta  
 Argonne National Laboratory  
 9700 South Cass Avenue  
 Argonne, IL 60439

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## ABSTRACT

Argonne National Laboratory-East (ANL-E) is a multi-program laboratory operated by the University of Chicago for the U.S. Department of Energy (DOE). ANL-E has incorporated its environmental compliance functions and pollution prevention (P2) activities into its processes. Examples of this include standard project and experimental reviews, targeted process analysis, and regulatory and oversight audits. ANL-E's implementation process has allowed us to meet our regulatory drivers as well as our internal goals with minimal resources. This paper reviews these processes and our implementation of the environmental and pollution prevention requirements which have led to an award winning P2 program.

## INTRODUCTION

Argonne National Laboratory-East (ANL-E) is a multi-program research laboratory operated by the University of Chicago for the U.S. Department of Energy (DOE). ANL-E's primary facilities are located on 1500 acre site 27 miles southwest of Chicago. There are fifty major building which house approximately 4000 employees.

ANL-E's mission is basic research and technology development to meet national goals in energy technology, environmental quality, scientific knowledge, and educational infrastructure. To accomplish its mission, ANL-E continually strives to improve its leading-edge capabilities in science and engineering, with emphasis on its core competencies. ANL-E's major mission areas are basic science, national research facilities, energy technologies, environmental technologies, national security technology evaluation, and education. As part of the ANL-E's mission is the policy to do work safety following the applicable environmental regulations. This includes the reduction in waste generation and recycling from our pollution prevention activities.

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ANL-E has a long standing history of conducting environmental compliance and pollution prevention activities that include regulatory permitting and the recycling of rare and radioactive materials. As the regulations have increased, both programs have developed and been incorporated into the site wide operations. The goal is to constantly look for ways to meet the environmental requirements in an efficient and cost effective manner.

Because of the diverse operations, ANL-E generates many waste streams. They include radioactive, hazardous, mixed (hazardous and radioactive), sanitary, and special waste which includes industrial process and biological waste. Our operations are unique because we generate many waste types but not in large quantities. The variety and the small quantities of waste types generated present a multitude of environmental compliance and cost issues. Therefore, ANL-E management has taken a multi-tiered approach that promotes the development and implementation of institutional policy and requirements with the flexibility of the research and operational groups to implement specific plans for their operations. Elements of this approach include: management commitment through ANL-E policy; review of current work projects; process waste assessments; and an internal request to fund the ANL-E programs pollution prevention projects. Special attention is also given to large program initiatives or program expansions which have large opportunities for pollution prevention and reduction in environmental compliance requirements through comprehensive planning (i.e., design for the environment). Examples of this work would be siting to avoid sensitive areas such as floodplains and development of "green" facilities. Technical support is provided by the Environmental Compliance Group and the Pollution Prevention Coordinator, as requested.

## **ENVIRONMENTAL AND POLLUTION PREVENTION PROGRAMS**

ANL-E's environmental and pollution programs developed as the regulatory programs evolved. Although some of the activities were done before there were regulatory drivers, the formal ANL-E programs which include record keeping, follow the regulatory drivers.

ANL-E is unique because we have three major regulatory agencies, the U.S. Environmental Protection Agency (EPA), the State of Illinois, and DOE. These drivers have made implementation of our programs complicated. DOE has its own regulatory authority and it voluntarily agreed to following some other federal regulatory programs. It has also implemented some federal requirements such as the National Environmental Policy Act (NEPA) in a more complex manner than other federal agencies.

The pollution prevention drivers for our faculty are listed below to illustrate the large number of requirements.

## **MAJOR REGULATORY DRIVERS FOR POLLUTION PREVENTION PROGRAMS**

Mixed Waste Minimization Action Report – Federal Facilities Compliance Act (FFCA) Section 3021(a)(2)(D) requires a description of waste minimization actions.

General Manifest Certification – Resource Recovery and Conservation Act (RCRA) Section 3002(b), 40 CFR 262,264.73(b)(9), requires sites and TSD operator to certify existence of their hazardous waste minimization programs.

Generator Biennial Report Certification – RCRA Section 3002(a)(6)(C), 40 CFR 262, 264.75(h), 265.75(h), requires sites to report on measures taken to reduce volume and toxicity of hazardous waste.

RCRA Part B Permit Conditions – 40 CFR 270.32, 271.14, requires site permits to contain conditions necessary to assure compliance with Parts 264 and 266-268 (e.g., hazardous waste minimization programs).

Expansion of TRI Reporting Requirements – Pollution Prevention Act (PPA) Section 6607, Expands SARA 313 reporting requirements to include toxic chemical source reduction and recycling information.

DOE Radiation Protection Program – 10 CFR 835, requires sites to maintain radiation exposures to as low as reasonably achievable, including radioactive waste and contamination, high contamination, and airborne radioactivity areas.

Pretreatment Program Reporting Requirements – 40 CFR 403.12(p)(4), requires site which discharges to POTW to certify that it has a program in place to reduce the volume and toxicity of hazardous wastes generated.

Stormwater Pollution Prevention Planning – 40 CFR 122.44(I)(4)(I), requires sites with stormwater discharge to maintain an on-site pollution prevention plan.

National Pollutant Discharge Elimination System (NPDES) Permit – 40 CFR 122.26(c), requires description of site pollutant control measures for stormwater discharges associated with industrial activities (i.e., central heating, transportation and grounds, central shops, etc.).

Federal Pollution Prevention Policy – Pollution Prevention Act (PPA) Section 6602, declares pollution prevention as the first choice in site environmental management.

Federal Procurement Guidelines – DEAR 970.5204-39, Encourages procurement of recovered materials by DOE sites.

Enforcement of Federal Waste Prevention, Recycling, and Federal Acquisition -RCRA Section 6002 (FFCA), requires sites to comply with guidelines on acquisition of recovered materials, requires tracking mechanisms, enforces provisions of E.O. 13101, and subjects sites to compliance inspections in determining compliance with Section 6002 and E.O. 13101. Exclusion to the Toxicity Characteristic - RCRA 40 CFR 261.4(b)(12) Encourages chlorofluorocarbon recycling.

National Ambient Air Quality Standards - Clean Air Act (CAA) Section 109, 40 CFR 50, FAR 52.223-2, Promotes emission reduction of six hazardous air pollutants.

Requirements for Non-Attainment Areas - CAA Part D and Section 112, FAR 52.223-2, establishes higher restrictions on criteria and toxic pollutant emissions for sites.

Protection of Stratospheric Ozone - CAA Sections 608 and 609, 40 CFR 82 (D), FAR 52.223-2, phases out CFCs, halons, and carbon tetrachloride by 2000; sets limits on emissions of ozone-depleting substance.

Reductions in Waste Generation - FAR 52.223-10, promotes reductions in waste generation.

## **POLLUTION PREVENTION AND ENERGY EFFICIENCY LEADERSHIP GOALS AT DOE FACILITIES**

Along with the regulatory drivers, DOE mandates national P2 goals and they are implemented at the local DOE offices. Below is a listing of the new goals for the DOE Laboratories.

DOE will strive to minimize waste and maximize energy efficiency as measured by continuous, cost-effective improvements in the use of materials and energy, with the years 2005 and 2010 as interim measurements points.

### **Reducing Waste and Recycling**

1. Reduce waste from routine operations by 2005, using a 1993 baseline, for these waste types:

Hazardous	90%
Low Level Radioactive	80%
Low Level-Mixed Radioactive	80%
Transuranic (TRU)	80%

2. Reduce releases of toxic chemicals subject to Toxic Chemical Release Inventory reporting by 90% by 2005, using a 1993 baseline.
3. Reduce sanitary waste from routine operations by 75% by 2005 and 80% by 2010, using a 1993 baseline.

4. Recycle 45% of sanitary wastes from all operations by 2005 and 50% by 2010.
5. Reduce waste resulting from cleanup, stabilization, and decommissioning activities by 10% on an annual basis.

### **Buying Items with Recycled Content**

6. Increase purchases of EPA-designated items with recycled content to 100%, except when not available competitively at reasonable price or that do not meet performance standards.

### **Improving Energy Usage**

7. Reduce energy consumption through life-cycle cost effective measures by:
  - 40% by 2005 and 45% by 2010 per gross square foot for buildings, using a 1993 baseline
  - 20% by 2005 and 30% by 2010 per gross square foot, or per other unit as applicable, for laboratory and industrial facilities, using a 1990 baseline.
8. Increase the purchase of electricity from clean energy sources:
  - (a) Increase purchase of electricity from renewable energy sources by including provisions for such purchase as a component of our request for bids in 100% of all future DOE competitive solicitations for electricity.
  - (b) Increase the purchase of electricity from less greenhouse gas-intensive sources, including, but not limited to, new advanced technology fossil energy systems, hydroelectric, and other highly efficient generating technologies.

### **Reducing Ozone Depleting Substances and Greenhouse Gases**

9. Retrofit or replace 100% of chillers greater than 150 tons of cooling capacity and manufactured before 1984 that use Class I refrigerants by 2005.
10. Eliminate use of Class I ozone depleting substances by 2010, to the extent economically practicable, and to the extent that safe alternative chemicals are available for DOE Class I applications.
11. Reduce greenhouse gas emissions attributed to facility energy use through life-cycle cost-effective measures by 25% by 2005 and 30% by 2010, using 1990 as a baseline.

## **Increasing Vehicle Fleet Efficient and Use of Alternative Fuels**

12. Reduce our entire fleet's annual petroleum consumption by at least 20% by 2005 in comparison to 1999, including improving the fuel economy of new light duty vehicle acquisitions and by other means.
13. Acquire each year at least 75% of light duty vehicles as alternative fuel vehicles, in accordance with the requirements of the Energy Policy Act of 1992.
14. Increase usage rate of alternative fuel in departmental alternative fuel vehicles to 75% by 2005 and 90% by 2010 in areas where alternative fuel infrastructure is available.
15. Ensure that all fleet acquisitions comply with the State of Illinois' Clean Fuel Fleet requirements.

## **GOALS**

The Secretary's Pollution Prevention and Energy Efficiency Leadership Goals are to be achieved on a Department-wide basis. DOE field offices will be responsible for developing appropriate goals for each of their cognizant sites and implementing pollution prevention and energy management site activities that are cost effective to DOE on a life-cycle basis. Field offices will assure goals are achieved by including goal requirements in annual performance plans or established performance agreements with each of their cognizant sites. Appropriate baselines for new sites will be established in performance agreements in cases where proposed baseline years do not apply.

### **Goals Under Development**

DOE will revise or issue additional goals as new pollution prevention and energy efficiency Executive Orders are released. Additional goals to be developed in Fiscal Year 2000 include: (1) the amount of energy generated at federal facilities from renewable energy technologies; and (2) water conservation and the methodology for determining the baseline for water consumption.

### **Implementation Processes and Systems**

ANL-E uses a multi-tiered approach to address its environmental compliance programs. There is a site wide program to control institutional permits and reporting such as our RCRA, NPDES, and CAA permits. Then there are institutional programs for project reviews and procurement. These systems include the NEPA program, the construction safety review process, and the affirmative procurement guidelines for purchasing. Each ANL-E Division/Department is required to have an internal experiment review process as well as coordinators for environment, safety and health.

The approach of each of these systems is to provide the researchers the maximum flexibility to do their work while meeting the regulatory requirements. A secondary benefit is the reduction of costs.

### ***Benefits***

There are many benefits to the coordination of the Pollution Prevention and the Environmental Compliance programs. There is a greater sharing of information necessary for both programs, cost savings and cost avoidance, proactive facility planning, compliance assurance, and reduction in regulatory requirements.

The compliance program has three areas of concern: maintaining compliance with the facility permits and requirements; planning new facility work and facilities; and correction of deficiencies. The areas of concern for the pollution prevention program are to implement a proactive program that looks to reduce or eliminate all types of waste and meet the pollution prevention regulatory requirements.

### ***Cost Savings***

A major benefit to both programs is the cost savings and cost avoidance associated with the pollution prevention and the compliance programs project and reviews. The cost savings can be reoccurring, a one-time benefit, a reduction in environmental liability or fines, or cost avoidance through the reduction of waste or the use of less energy.

### ***Reduced Regulatory Burden***

The multi-tiered program looks to reduce regulatory burden in several ways. One is to reduce or eliminate waste generation to avoid the regulatory requirements completely. Recycling is also used in this way to divert waste streams avoiding regulatory requirements or reducing the level of regulatory programs such as the reduction of requirements from a hazardous waste to a special waste. Planning of new work projects is performed to avoid materials that when disposed would be regulated such as CFCs in cooling systems, mercury switches, and incorporation of energy conservation devices and equipment to reduce operating expenses.

## **DESCRIPTION OF PROJECTS, PROGRAMS, OR TECHNOLOGIES**

### **Phytoremediation Project**

Solid and liquid waste from ANL-E activities were disposed of in the 317 and 319 Areas during the 1950s. Volatile organic compounds (VOCs) and tritium have been released into the soil and groundwater from those wastes. Previously completed actions have removed about 80% of the

contaminants. ANL-E is now using phytoremediation to eliminate any remaining risk to the groundwater.

Phytoremediation is the engineered use of green plants, such as trees and grasses, to remove groundwater from the subsurface and destroy the VOCs in the soil and groundwater. The process of transpiration moves water from the subsurface through the plants' roots into their tissues, and eventually through openings in the leaves to the air. During this process, contaminants in the water are also taken up by the plants. The contaminants are stabilized, stored in the plant, broken down into less toxic compounds, or vaporized out of the leaves with the transpired water.

The 317 and 319 Areas phytoremediation system consists of hybrid willow and poplar trees. Approximately 800 trees were planted. The planting of these trees was completed in September 1999. A herbaceous groundcover was planted between the trees to control erosion and minimize water infiltration. The trees are approximately 15 feet tall with a 10-foot-long root mass (total length 25 feet).

The phytoremediation saved approximately \$500,000 in remediation and disposal costs and a cost avoidance of approximately \$90,000 of yearly operation and maintenance costs.

### **Zero-Valent Iron Addition Technology**

ANL-E implemented an innovative technology that improves the efficiency and cost-effectiveness of removing VOCs from contaminated soil. Through the injection of a water slurry containing metallic iron particles into contaminated soil, in combination with enhanced soil mixing, the concentration of VOCs in the soil was significantly reduced. This project allowed for the in-place treatment of the contaminated soil, eliminating the need to excavate more than 20,000 cubic feet of highly-contaminated soil for treatment.

They estimated cost savings attributed to eliminating the excavation, handling, transport, and disposal of this waste stream are \$9,000,000.

### **Sanitary Waste Reduction Projects/Activities**

During 1998, through the continued improvement and implementation of recycling, waste reduction, and assessment programs, ANL-E successfully met, and surpassed, the 1999 DOE Pollution Prevention Goals for sanitary waste. In April 1999, ANL-E received the 1999 DOE Pollution Prevention Award for Sanitary Waste Reduction. This prestigious award was presented to ANL-E for its continuous improvement in the areas of recycling, waste reduction, assessment, and education programs. ANL-E reduced the generation of sanitary waste from routine operations by over 50% in 1998, as compared to the 1993 Baseline. ANL-E also recycled 68% of sanitary waste from all operations in 1998. Although 1998 was a successful year for its solid waste

reduction and recycling programs, ANL-E continues to assess, improve, and expand these programs to achieve continuous improvement.

The sanitary waste reduction activities resulted in approximately \$350,000 of cost savings and revenues.

### **ANL-E and DuPage County Sludge Pump Project**

A cooperative effort between ANL-E and the DuPage County Public Works Department involved the transfer of two excess positive displacement pumps from DuPage County for use at ANL-E's sanitary treatment plant. Recent upgrades to DuPage County's Woodridge Green Valley Sanitary Treatment Plant rendered the two pumps expendable. The excess pumps were found to be compatible with conditions and requirements at ANL-E's treatment plant for pumping wastewater treatment sludge. Although previously used, these two pumps are a distinct upgrade from ANL-E's preexisting equipment. These pumps will make the pumping of sludge less difficult and more efficient, while incorporating the use of "scrap" equipment.

The costs of the pumps is approximately \$50,000 and ANL-E is currently sending its predigested sludge to the county for a savings of approximately \$20,000, annually.

### **Energy Reduction Cooperative Program**

1998 was the seventh consecutive year that ANL-E participated in Commonwealth Edison's Energy Cooperative Program. Under this program, ANL-E voluntarily reduced electrical usage during peak demand periods. The objectives of this cooperative project are to demonstrate a viable alternative to construction of additional power plant capacity for purposes of providing peak demand and to conserve energy, thus resulting in P2.

This program results in revenues of approximately \$140,000, annually.

### **ANL-E Extension Bridge Project**

ANL-E implemented an extension bridge demolition and construction project that emphasized its commitment to P2 within construction and demolition projects. The Eastwood Drive Extension Bridge (constructed in the 1950s) had suffered severe corrosion and deterioration and was to be dismantled and replaced. In addition, the new roadway for the bridge was paved with recycled materials.

This project realized a cost avoidance of approximately \$35,000.

## **ANL-E Boilerhouse and Cooling Tower Projects**

ANL-E's Plant Facilities and Services organization has implemented P2 projects within the coal and natural gas-burning boilerhouse, and at the largest cooling towers on the site. Chemical storage and management improvements at the boilerhouse, coupled with a recently employed technology called TRASAR, offers more efficient chemical management, and the first-ever Real-Time chemical control at the boilerhouse. In addition, ANL-E has recently employed the use of a new patented liquid biocide called STABREX for water treatment at its largest cooling towers.

The TRASAR technology has generated approximately a \$20,000 cost savings and the STABREX process also generates approximately \$20,000 of cost savings per year.

## **CONCLUSIONS**

Pollution prevention and environmental compliance work in concert to achieve waste reduction, compliance, and a reduction in environmental liability. Working together allows maximum resource usage by coordinating activities and by not duplicating efforts. Both programs continually evolve and our goal is to demonstrate our leadership by meeting and exceeding our regulatory requirements, performance measures, and internal goals. The key elements supporting this program enhancement are to:

- Develop and implement program enhancements that incorporate the findings and recommendations of the ANL-E's performance assessments.
- Facilitate innovative approaches to the waste management and pollution prevention and the environmental compliance program.
- Identify and integrate applicable external waste management and pollution prevention innovations and technologies into the ANL-E program.
- Build upon and establish new technology transfer initiatives with external partners and seek opportunities to develop new partnerships.

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by Mark A. Kamiya and Keith Trychta

## **KEYWORDS**

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