

## U.S. DEPARTMENT OF ENERGY DEFENSE PROGRAMS' APPROACH TO POLLUTION PREVENTION TECHNOLOGY TRANSFER/INFORMATION EXCHANGE\*

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### ABSTRACT

Pollution Prevention can decrease operations costs, lower the volume and toxicity of wastes and improve manufacturing and process efficiencies. In order to ensure that Defense Programs (DP) consistently conducts an effective Pollution Prevention Program, DP has adopted a three-pronged approach to Technology Transfer and Information Exchange.

DP has developed an information exchange program with industry, academia, and other government agencies to share lessons learned relative to pollution prevention and waste minimization. This program includes aggressive outreach initiatives and benchmarking efforts. Secondly, DP is conducting awareness training and technology workshops that provide practical information on the positive alternatives to treatment and disposal. In addition, a quarterly newsletter is circulated to nearly 2000 recipients inside and outside the Department. Thirdly, DP has also made significant strides in improving operating practices so as to preclude the generation of waste in weapon component production. Many technologies developed at the National Laboratories have already been introduced into industry through technology transfer forums.

### INTRODUCTION

The Department of Energy (DOE) recognizes that national priorities are changing because of a changing world political structure and has joined with the public and academia in a collaborative effort to solve the nation's environmental problems. DOE's Waste Minimization Crosscut Plan (issued in May, 1992), the Secretary of Energy Notice 37-92 (an implementing guideline for the Crosscut Plan also signed in May), and the Secretary's Policy on Waste Minimization and Pollution Prevention (August, 1992), are the most recent indications that DOE supports waste minimization/pollution prevention as a viable means of reversing the trend of environmental degradation. DOE's Defense Programs (DP) is one DOE office that is affected by the Department's commitment to a pollution prevention approach. DP also believes in the policy and is the first office to have developed a Pollution Prevention Strategic Plan (issued in April, 1992) to implement that policy.

Whereas activities at DP National Laboratories and Production Facilities were for years cloaked in secrecy (open discussions relative to materials and processes were not allowed), the current challenge is to exploit any and all means of communication to the fullest extent possible in the efforts to find solutions to environmental problems. An important part of this communication is providing good information to U.S. citizens regarding DOE plans to prevent additional insult to the environment. In fact, this presentation to this audience today is an example of DP's Outreach Program. Before discussion of DP's various modes of information transfer, it may be worthwhile to look into the "scope of work" addressed by pollution prevention/waste minimization initiatives.

Defense Programs is concerned that neither the public nor the Congress may understand the need for and application of waste minimization within the Nuclear Weapons Complex and its application(s) to the private sector. Some have ques-

tioned the significance of the term "pollution prevention" when the weapons production system is nearly dormant. DP feels it is important that the public understand that dismantlement of this system will generate large volumes of material that is no longer serving its original intended purpose. Some of this will become hazardous waste, some will become radioactive waste, and some of the byproducts of dismantlement will contain both hazardous and radioactive components thereby becoming "mixed" waste. All of these have associated fiscal and environmental costs.

Recovery and reclamation during dismantlement and during ongoing processes will reduce the volume of hazardous, radioactive or mixed waste, and will reduce the need for production or purchase of some quantity of new stock. Recovery, reclamation, and recycling (considered an aspect of pollution prevention by DP, if not by EPA) are activities that are typically applied to the retrieval and/or reuse of some material or product that has already been used. For example, the expense associated with the production of enriched uranium has been one incentive for tracking and salvaging uranium from the medium that it may have contaminated. Similarly, many photographic laboratories now try to recover the silver from spent solutions before disposal of those waste streams.

Recovery, reclamation and recycling can be applied to materials other than manufacturing byproducts. The DOE has numerous desks, computers, chairs, file cabinets laboratory equipment and so forth that are being stored indefinitely because they are not "pedigreed." These items cannot be released because there is no proof that absolutely no radioactivity has been added to the items during their use at DOE sites. The public should know that waste minimization/pollution prevention can be applied to materials and processes at sites throughout the Complex that could become something other than "waste" if the proper approach is defined and implemented.

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Another area for the application of waste minimization/pollution prevention techniques and technology is that associated with legacy wastes, the result of 50 years of nuclear weapons development and production. Methods must be found to separate hazardous materials from non-hazardous materials, to convert hazardous materials into less hazardous forms, and to identify acceptable long term hazardous material storage techniques.

Finally, waste minimization/pollution prevention will be considered in the design of any new processes, facilities or future reconfiguration of the Nuclear Weapons Complex.

Recognizing that pollution prevention can decrease dismantlement, operations, maintenance and (ultimately) remedial action costs by lowering the volume and toxicity of wastes and improving manufacturing and processing efficiencies, DP is actively addressing the above problems via the aggressive implementation of a Waste Minimization/Pollution Prevention Program throughout the Weapons Complex. One important part of this program is a three-pronged Technology/Information Exchange Program that supports the Pollution Prevention effort. This three-pronged approach consists of: Benchmarking, Information Exchange, and Technology Transfer.

### BENCHMARKING

The routine exchange of information and techniques (both within the Department and between DOE and outside Federal and public entities) promotes a quick response to new and innovative ideas so that no organization has to start from ground zero on each waste minimization idea. A successful Benchmarking Program enables an organization to determine if its program is moving forward or is at a standstill. Priorities may then be modified as appropriate.

Since the private sector was subject to regulation under the Resource Conservation and Recovery Act (RCRA) nearly four years before DOE was required to comply with the act, DP considered that U.S. industries may be willing to share "lessons learned" during their efforts to minimize regulated activities (and costs) by minimizing waste. Information of this nature is an excellent tool in helping to significantly reduce the time necessary for development and analysis, technical and economic evaluations, prioritization, and implementation of any proposed pollution prevention activity.

One year ago, DP established a Benchmarking Team that reviewed pollution prevention practices with representatives from Imperial Chemical Industries (ICI) Americas, the Rohm and Haas Company, Aluminum Company of America (ALCOA), and Delmarva Power Company. The Team identified numerous business and process practices that were common to all of the companies, then compared these practices. The report on this latter tour was issued in January of this year by DOE Defense Programs.

One result of the benchmarking efforts is that information from the private sector spanning a wide range of subject-related topics has been made available to interested and involved parties at DP National Laboratories and Production Facilities. The benchmarking report is included in training manuals that are distributed to the senior and mid-level DOE managers and DOE contractors who participate in the Pollution Prevention Workshop. The information is also distributed to DP's designated managers for specific waste streams that are generated throughout the Complex. The report is a living document that is reviewed and improved upon by the

managers who have the authority to apply the information it contains. Future revisions of the Benchmarking Report will include a lessons learned section and updates on current Pollution Prevention efforts.

Another positive result of personal interviews with representatives of private industries is that contacts were established at the companies that were visited by the Benchmarking Team. Representatives from five of the six companies that were benchmarked in the last two years will participate in the DP-sponsored Pollution Prevention and Integrated Technologies Workshop that will be held in March in Santa Fe, New Mexico. The Benchmarking Team discovered that the individuals who have developed and implemented effective pollution prevention programs are interested in seeing their "tried methods" applied at other suitable sites. One company went so far as to allow DOE wholesale use of their own waste minimization plan. Another offered software that had been developed in-house for managing environmental information.

### INFORMATION EXCHANGE

To foster the development of the waste minimization program, DP has addressed the need for pollution prevention awareness by conducting pollution prevention workshops and training for DOE and DOE contractor senior management. The half-day workshops include a manual that covers implementation of a waste minimization program and discussion of the leadership required to keep it effective. The manual also provides a summary of environmental regulations that are affected by or that mandate waste minimization. Additionally, the economic, legal, and social incentives for waste minimization/pollution prevention are outlined. Appendices to the manual constitute other vehicles for information exchange:

- Model Process Waste Assessment Plan
- Model Waste Minimization Plan
- Waste Minimization Contact List
- "Benchmarking Report"

DP is also conducting biannual Technology Workshops that provide practical information on the positive alternatives to treatment and disposal. Pollution prevention opportunities are identified and stimulating technical papers on dual-use technologies are presented in these workshops, which are offered not only to DP personnel but to anyone in the Department of Energy as well as several invited participants from the private sector and academia.

DP publishes a quarterly newsletter, the *Pollution Prevention Advisor*, that highlights DP initiatives in the area of pollution prevention, recent rulemaking, and case studies from industry. The publication is distributed to DOE and DOE contractor employees, to Members of Congress, and to other interested parties in EPA, Industry and Academia.

DP personnel participated in the "Waste Minimization and Pollution Prevention" Video Conference produced by the University of New Mexico's College of Engineering and the Waste-Management Education and Research Consortium. This eight-program series began in March, 1992 and concluded in October, 1992. The series was honored at TeleCon XII by being awarded the "Best Distance Learning Program for 1992 Higher Education - Live Programming" from the United States Distance Learning Association. Each four-hour program provided interactive satellite television courses focused on waste minimization, including demonstrations of technology for accomplishing waste minimization and



discussions of regulations related to waste minimization. With a strong emphasis on technology transfer, each program offered four to six presenters. DP personnel presented two segments titled, "Why Minimize Waste" and "Process Waste Assessments in the DP Complex."

In 1988, the DOE established the Waste Reduction Steering Committee (WRSC) comprised of members from most of the DOE program secretarial offices (PSO) and cochaired by DP and Environmental Restoration and Waste Management (EM). The WRSC provided a comprehensive approach to pollution prevention within the DOE. Through their site visits to DOE facilities, members of the Committee were able to gather and disseminate ideas that promote pollution prevention awareness and benefits within DOE.

DP is convinced that it is important to publicize progress in the field of waste minimization and pollution prevention. To this end, DP has published articles and presented papers that describe the development and implementation of the office's pollution prevention program. This information transfer to other offices in DOE and to other federal agencies, as well as to the public, invites comment and feedback. Publicity provides the opportunity for DP to ascertain the degree of the perceived effectiveness of its waste minimization/pollution prevention programs and the need for this information in the private sector.

#### TECHNOLOGY TRANSFER

The Department of Energy and other federal agencies, including the Environmental Protection Agency and the Department of Commerce, are working toward the goals of cleaning up the environment and improving the manufacturing competitiveness of our country. DOE perceives the importance of technology transfer and has unequivocally stated that technology transfer is an important part of doing business in the future.

The Department of Energy recognizes that its National Laboratories and Production Facilities possess a vast amount of technical talent and information useful for improving the competitiveness of American Manufacturing. In a joint Memorandum of Agreement (MOA) between DP and EM, the two parties agreed to jointly fund pollution prevention research and demonstration projects within the DOE. (EM and DP are the major stakeholders in this process as DP and EM are waste generators and EM is chartered to clean up and dispose of the waste.) To carry out these activities, the Waste Minimization Management Group (WMMG) was chartered and established within the DOE Albuquerque Operations Office. The primary responsibility of the WMMG was to formulate and implement a complex-wide program to address waste and hazard minimization at the front end of a process from design through production and retirement. Within the DOE, the following nine waste streams were identified: solvents, polymers, plating, miscellaneous, plutonium, uranium, tritium, energetic materials and mixed wastes. A Waste Stream Manager was appointed for each waste stream and was charged with the responsibility of ensuring that the R&D activities address ways for the plants and laboratories to reduce hazardous materials and minimize waste. As part of this initiative, DOE has taken a systematic approach to pollution prevention by prioritizing chemicals with the highest volume usage and toxicity characteristics at all of its production plants. On the non-nuclear production side of DOE, the WMMG has focused on the reduction of solvents such as chlorinated hydro-

carbons (CHCs) and chlorofluorocarbons (CFCs); plating chemicals such as hexavalent chromium, cadmium, and cyanide; and polymers such as toluene diisocyanate and 4,4'-methylenedianiline. The WMMG uses technical waste stream managers within the Weapons Complex to guide developments and ensure proper emphasis on projects. Through teamwork and integrated approaches, this group has made significant technical inroads into complex DOE-wide pollution prevention issues.

Many of the technical accomplishments in the area of waste minimization and pollution have been described in the WMMG's recently published *Waste Minimization Program Accomplishments*. This report has the same circulation as the *Pollution Prevention Advisor* and is one of DP's primary vehicles for technology transfer. As with the newsletter, contacts' names are listed under articles and readers are encouraged to write or call with comments or questions on respective topics.

The technology being developed in the Nuclear Waste Complex by DOE or in conjunction with private companies in many cases is applicable in the commercial sector. By teaming with other organizations through a variety of cooperative programs, technology is shared. In some cases, research and development has addressed specific commercial environmental pollution problems. For example, under the Technology Transfer program the WMMG waste stream managers receive requests for help that they direct to the appropriate contractor. In one example, small manufacturers were helped to eliminate the use of ozone depleting 1,1,1 trichloroethane solvent previously used in cleaning medical instruments. In another case, waste stream managers are helping a company to convert to the use of a low VOC paint system and is developing the process for using sprayable powder coatings. One small manufacturer has requested assistance with setting up a new cleaning line that will use aqueous cleaning in place of trichloroethane, a suspected carcinogen. The DOE production facilities are working with various National Institute of Standards and Technology-funded Technology Centers throughout the country providing training and seminars covering various technologies of interest to small and medium manufacturers. (For example, in August 1992, AlliedSignal Engineers from DP's Kansas City Plant teamed with Lawrence Livermore National Laboratory to present a seminar on solvent substitution for cleaning. This program, originally broadcast in California, will soon be broadcast to all Technology Centers throughout the country.) Technology transfer is occurring in many forms including direct technical assistance, seminars, workshops, video training, published articles and pamphlets and training.

An integrated demonstration project of Environmentally Conscious Manufacturing (ECM) was sponsored by the WMMG. This project was a joint effort of Sandia National Laboratories/New Mexico and the Kansas City Division of AlliedSignal. ECM is essentially designing the hazardous materials out of a product and the processes that produce that product. With ECM, waste minimization and pollution prevention are considered up-front in the product conception phase. In order to minimize waste and prevent pollution, concurrent engineering with design labs must be employed at product inception. Product design, raw materials and process selection, design for dismantlement and recycling are all key issues to ECM. In the joint Sandia/Kansas City project, an electrical subsystem was selected for the ECM demonstration. Processes that produced hazardous waste, that used

suspected carcinogens, that polluted the air, that depleted the ozone layer or that were simply inefficient because they produced excessive waste, were not considered supportive of ECM. Engineering drawings and work instructions were used to identify eight materials and processes which fell into the category of non-environmentally conscious. Six of these materials and/or processes were replaced by environmentally conscious materials and processes. At the conclusion of the production run of twenty-two electrical units, the waste generated using the "standard" manufacturing operation was compared to the waste generated using ECM. The results were dramatic! ECM significantly reduced the amount of waste and pollution. In addition to the reduction of waste, this project illustrated the importance of getting up-front commitment to ECM. Real-world evaluation and feedback was necessary to assure the efficacy and practicality of the chosen alternatives to the "tried and true" operations. Therefore, the project also demonstrated the value of technology and information exchange among individuals from a variety of backgrounds who are focused on the same objective, namely pollution prevention.

### CONCLUSION

Defense Programs still has as its primary mission the responsibility of ensuring national security through nuclear

deterrence. However, shifting priorities are reflected in shifting funds and, at this time, the EM budget exceeds the budget for defense spending. The most sensible way to minimize environmental impact is to stem or reduce the sources of contamination. Personnel resources are available, in the form of highly trained research scientists, process engineers, technicians, and operators (to name but a few) who can help find alternatives to processes and materials that pose unacceptable human health or ecological risk. Facilities and equipment are also available for demonstrations of innovative waste minimization technologies. DP is poised to explore new avenues internally at the same time it is seeking direction from academia and the private sector. DP is also ready to share findings with other interested parties. While DP expends considerable effort in outreach and technology transfer to U.S. industries, it attempts to maintain the momentum within the Department with aggressive advertising of the benefits of waste minimization. DP recognizes that commitment at every level of the organization is the key to success in its pollution prevention programs. This commitment is encouraged by DP Senior Management's recognition that Pollution Prevention is the hallmark of future environmental policy and their relentless efforts to incorporate pollution prevention into everyday operations.