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Information Exchange within the U.S. Department of Energy Pollution Prevention Community

by J. R. Thuot

Argonne National Laboratory, Argonne, Illinois 60439
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OF ENERGY POLLUTION PREVENTION COMMUNITY

by

James R. Thuot

Environmental Management Operations

July 1995

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NOTATION

The following is a list of the acronyms and initialisms used in this document.

ANL	Argonne National Laboratory
BBS	bulletin board system
CSO	Cognizant Secretarial Office
D&D	decontamination and decommissioning
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DP	Office of Defense Programs
EM-334	Waste Minimization Division
E-Mail	electronic mail
EPA	U.S. Environmental Protection Agency
EPIC	Energy Pollution Prevention Information Clearinghouse
EPRI	Electric Power Research Institute
ES&H	Environment, Safety and Health
FTE	Full-time equivalent (one person-year of effort)
FTP	File Transfer Protocol
FY	fiscal year
HMIX	Hazardous Materials Information Exchange
HQ	Headquarters
LAN	Local Area Network
PIES	Pollution Prevention Information Exchange System
PNL	Pacific Northwest Laboratories
PPOA	Pollution Prevention Opportunity Assessment
PP/WMIN	Pollution Prevention and Waste Minimization Program
RADWIG	Research and Development Laboratory Working Group
TQM	Total Quality Management
SysOp	system operator
WAN	Wide Area Network
WIN	Waste Information Network
WMCCG	Waste Minimization Contractor Coordinator Group

**INFORMATION EXCHANGE WITHIN THE
U.S. DEPARTMENT OF ENERGY
POLLUTION PREVENTION COMMUNITY**

James R. Thuot

ABSTRACT

Improving Pollution Prevention and Waste Minimization Program (PP/WMIN) technologies, actions, and culture could be an important cost-cutting step for the U.S. Department of Energy (DOE). Communicating ideas, concepts, process changes, and achievements is essential for the success of this program. The need to openly communicate ideas and concepts in a cost-effective manner is essential in an organization that has such diverse components as research and development, weapons production, and power generation. This approach is in contrast to the historic DOE culture developed within the cold war period in which compartmentalization, independence, and secrecy were stressed. DOE has now recognized that for any pollution prevention program to be successful, the many diverse elements of the organization must share information. Avenues for such information exchange are examined in this report.

SUMMARY

This report reviews three primary modes of communication for exchange of pollution prevention information: oral (i.e., meetings), written (i.e., documents), and electronic (i.e., information exchange system). Each communication method has specific advantages and disadvantages. No one method will address all of the needs of an audience. The following methods of communication are recommended for the PP/WMIN program:

1. A DOE national PP/WMIN meeting should be held annually. Other federal agencies and private industry should be included. The audience for this meeting would be the mid-level manager and/or the pollution prevention professional. The meeting should facilitate dissemination of policy, networking, and the generation of ideas.
2. Meetings or workshops should be held on specific areas of pollution prevention (vehicle maintenance, custodial services, etc.). Such meetings should target the first-line supervisor, researcher, or worker. The DOE Office of Defense Programs has conducted one workshop with this focus. The audience consisted of the people actually doing the work. DOE should encourage participation in activities such as these.

3. A newsletter featuring DOE PP/WMIN activities currently exists (*Pollution Prevention Advisor*) and is a very valuable tool for communicating broad ideas across all management levels. Upper management can conveniently browse the newsletter and initiate action on what it has read; the first-line reader can see an idea or article and call the respective party for additional information. DOE should encourage expansion of the readership of this periodical.
4. DOE pollution prevention communication efforts should be expanded to include other elements of the federal government and opened to industrial input as well.
5. The final method of communication should be electronic. Recent attempts in this area have only achieved mixed success. Electronic communication can be very effective for mid-level management, the PP/WMIN professional, and first-line managers. The U.S. Environmental Protection Agency developed the Pollution Prevention Information Exchange System (PIES); however, this system had format, funding, and technology problems. DOE recently began improving this system by developing the Energy Pollution Prevention Information Clearinghouse (EPIC), which has been in existence for about two years. Current DOE effort should be expanded with the following recommendations:
 - a. The DOE EPIC system should be formally developed with the ultimate goal of replacing PIES and a long-range goal of becoming a significant component of a worldwide technology web.
 - b. The system must have a consistent, long-term funding program to allow for effective management, planning, expansion, and stable operation.
 - c. System software should be designed around the most effective and flexible software platform available when programming begins.
 - d. The system should be managed by database and electronic communication professionals.
6. Centers of excellence should be established at various DOE locations to provide technical expertise and solicitation and review of articles for publication, as well as to serve as resource centers for detailed knowledge of specific topics.
7. A central schedule of events should be established in order to eliminate conflicts in schedule and priority. This schedule should be incorporated into the EPIC Database.

1 INTRODUCTION

Pollution prevention is a concept that crosscuts the entire U.S. Department of Energy (DOE) system from top to bottom and program to program. Because of this situation, communication among managers, researchers, supervisors, and workers and across program elements is essential for the success of the Pollution Prevention and Waste Minimization Program (PP/WMIN).

For purposes of this report, communication is defined as the dissemination of information on policy, program, and activities by oral, written, or electronic means. It is particularly important that communication flow from upper management to middle management and functional levels of an organization. Information exchange includes communication but is expanded to include all types of ideas and media. Information exchange is critical for program management and operation.

Currently, DOE has numerous communication and information exchange systems that the various elements and programs use; most, however, do not emphasize pollution prevention. The Waste Minimization Division of DOE (EM-334) recognizes the shortcomings of current information exchange practices and has funded this study to review such practices and develop recommendations for future direction in this area.

Three distinct tiers of management need to communicate and exchange information (see Table 1). The first functional tier is the lower level of information exchange and communication. This tier is the functional level of line management, which consists of the supervisor, researcher, or worker directly responsible for the work and the individuals doing the work (i.e., those actually generating waste). This level is absolutely critical to the success of

TABLE 1 Management Tiers

	DOE Headquarters	DOE Field Office	Contractor
Upper management	Secretary Senior managers (Cognizant Secretarial Offices [CSOs]) Senior staff Senior directors and managers	Field office managers Area office managers Contractors' officers Senior field office managers	Laboratory directors Associate directors Assistant directors Senior division directors
Middle management	Division directors Department heads Program managers	Division directors Department heads Program managers	Division directors Department heads Program managers
Lower-level management	Project managers Engineers Supervisors	Project managers Engineers Supervisors	Project managers Engineers Supervisors Workers

the project because activities are actualized at this level. Workers possess very detailed knowledge of the particular process for which they are responsible but have limited knowledge of the big picture of pollution prevention. They receive extensive awareness training in such activities as Environment, Safety and Health (ES&H), Conduct of Operations, Total Quality Management (TQM), etc., but have limited awareness of the overall pollution prevention program. This group has access to computers and periodicals and may occasionally attend meetings. This group implements the program and makes the difference between a highly successful program and failure.

Middle management is currently the primary level of information exchange. This level includes the pollution prevention program manager and staff, facility management, and the actual program implementation level, which includes implementation planning and program planning. This level is where responsibility for the overall program lies and where the overall program, policy, and objectives are understood. People at this level are not involved in the details of field activity, and communication takes place via periodicals, newsletters, electronic mail and bulletin boards, and meetings and workshops. People at this level are responsible for program implementation and distribution and expenditure of resources at the local level.

Finally, upper and senior management of both DOE and contractor organizations communicate at a planning and policy level. This group is responsible for setting policy and supplying resources. At this level, oral and written communications of a conceptual nature predominate information exchange and do not involve intricate detail. Because information exchange at this level is typically via written communication of a summary nature and occurs at infrequent meetings, it will not be addressed in detail.

Historically, the pollution prevention field has relied on semiannual or annual meetings and workshops and other infrequent gatherings to communicate and cross-fertilize ideas between sites and individuals. This infrequent communication has led to different sites doing redundant work, some sites not being involved at all, and others seeking direction and answers. This inefficient information exchange system hinders expeditious flow of information and prevents information from reaching the most effective levels of the organization. For example, annual meetings of pollution prevention managers emphasize policy and selected activities; however, this information is not passed on to workers.

This report emphasizes pollution prevention information exchange links at the lower two levels of operation. The goal of the report is to provide recommendations to EM-334 so that information exchange within the DOE system can be optimized for the purpose of pollution prevention. Information exchange links are essential for four reasons:

1. Mid-level managers who work with program implementers must have a detailed understanding of policy requirements and drivers, goals, and funding in order to plan and develop program.
2. Communication of implementation ideas and practices is essential for both management and workers so that redundancy is reduced. Different

sites and facilities have developed Pollution Prevention Opportunity Assessments (PPOAs) and implemented recommendations. Communicating the assessments and implementation results is essential so that other sites do not have to reinvent or commit scarce resources to solve the same problem.

3. Because sites conduct similar activities, implementation can be accelerated by information exchange of PPOAs and ideas that are important to the worker level.
4. Regulatory requirements and guidance must be communicated. Having the resources available so that regulatory impact can be determined can have a significant effect on the conceptual design of projects.

This report will present an assessment of the current status of information exchange on pollution prevention and will recommend actions for improving information exchange between mid-level and first-line managers. Cross-fertilization at these levels is essential for an efficient, cost-effective program. While emphasis will be placed on using systems currently in place, or systems that can be expanded with reasonable ease, new ideas will also be explored.

2 METHODOLOGY

This project was initiated with an informal survey of pollution prevention professionals to determine their views of the current status of information exchange. Then a review of how several commercial companies conduct information exchange and communicate internally and externally was conducted. Finally, input from a session at the first Waste Minimization Contractor Coordination Group (WMCCG) Tools Workshop, which focused on technology transfer, was incorporated.

The initial information exchange survey was distributed at the Eleventh Annual DOE Pollution Prevention Conference in San Francisco (April 1993) and at the WMCCG Tools Workshop held in Tampa (May 1993). Approximately 50 responses were received. The survey contained six basic questions dealing with upper-level management knowledge and support, types of information exchange media (newsletters, meetings, and workshops), and electronic media.

The first survey question asked whether the respondent knew or thought upper-level management (laboratory director or site manager) had read the *1992 Waste Minimization Pollution Prevention Crosscut Plan* (DOE 1992, DOE/FM-0145, Office of Science and Technology Information, Oak Ridge, Tenn.) and whether upper management supported the program. Interestingly, 44% of the respondents said their laboratory director had read the crosscut plan; 35% said their site managers had read the plan; and 76% of the respondents believed their upper management supported the program. These responses probably indicate that middle and lower management believe that the crosscut plan was passed down for action with direction to implement but was not read and understood by upper-level management. On the basis of program performance, the numbers appear to be too high; upper-level management may have seen the crosscut plan but did not read or buy into the concept. This would explain the spotty or ineffectual support the program has had from upper management. These responses also indicate an inadequate flow of information vertically. Since this survey, DOE has placed much more emphasis on pollution prevention; senior- and upper-level management are now more familiar with the concept of pollution prevention; and budgets are getting more attention, resulting in improved implementation. The problem of vertical information flow is significant, however, because this is one of many programs or activities at a site, and annual upper-level program review may be lacking.

The next survey question asked whether a newsletter would be useful and at what frequency it should be published. The results were about equally divided between monthly and quarterly publication of a newsletter. Detailed discussion of this followed at the Tools Workshop.

The next two questions discussed workshops and annual meetings. The respondents were very divided about workshops — 30% favored annual, 40% favored semiannual, and 27% favored irregular workshops on specific topics. A significant majority (80%) of the respondents favored holding an annual meeting.

The last question discussed electronic media. Respondents were given a choice of three media: U.S. Environmental Protection Agency (EPA) Pollution Prevention Information Exchange System (PIES), Waste Information Network (WIN), and electronic mail (E-mail). The responses were mixed; a majority (80%) favored either E-mail or PIES (75%) or a modification to these programs.

The WMCCG Tools Workshop involved a discussion group of 16 people from 9 different organizations. A wide perspective of needs was represented, from the pollution prevention professional to the worker. This group spent significant effort discussing electronic and printed media communications. Barriers to effective implementation and characteristics of effective systems were identified.

Hazardous Materials Information Exchange (HMIX) staff members evaluated computer information exchanges. They provided valuable information from the perspective of the professional system manager. In addition, Argonne National Laboratory (ANL) staff familiar with computer and electronic information systems reviewed and developed ideas in this rapidly changing field.

The final method of gathering background information consisted of attending various conferences and workshops and discussing information exchange with the participants. This proved very valuable from two perspectives: first, it served as an excellent critique of conferences and meetings, and second, it provided a forum for discussion with industry representatives.

Discussions with meeting and workshop participants proved very enlightening. Whereas participants would typically give a meeting high ratings on post-meeting survey forms, they frequently had additional comments they would voice but not put into writing. These would range from critical comments about speakers and content to meeting timing, facilities, and location. Most participants seemed to get more useful information from one-on-one discussions with speakers than from any formal presentation.

Discussions with industry representatives indicated that they have a great deal of valuable information to share and some that is closely held. Industrial companies have been in the pollution prevention business longer than DOE and for somewhat different reasons. They are looking to improve their processes, achieve economic benefits, and obtain competitive advantage. Because of the competitive nature of the private sector, information exchange should be divided into two distinct types — information that can be shared and proprietary information. This could crudely be likened to DOE's open programs (Energy Research, Conservation and Renewable Energy, Fossil Energy, etc.) and restricted defense programs.

The private sector participates in industrial workshops, meetings, publications, and electronic media to communicate nonproprietary information. Industry representatives can be very valuable resources because they have solved or explored many of the problems DOE faces. They use internal company meetings to discuss programs of a proprietary nature. Proprietary information is typically related to actual process, materials, and techniques and can be directly related to competitive advantage.

3 AUDIENCE

Pollution prevention has become a new and important priority within the present administration, Congress, and competitive industries. The federal government does not hold any all-encompassing pollution prevention meetings, yet all government departments are required to develop programs in this area. Present DOE meetings focus strictly on an internal audience with incidental participation by industry, the EPA, or other departments. Expanding present PP/WMIN meetings to encourage participation by other agencies would provide several advantages: (1) DOE would be recognized as taking a lead in PP/WMIN within the government, (2) other agencies with waste minimization problems would benefit from DOE experience, and (3) other agencies would have solutions that DOE can use.

The audience for information exchange is critical to the usefulness of the information. Information improperly formatted or presented to the wrong audience can lose its value. Important examples of this include the following:

1. Upper-level management attention is constrained by limited time to receive and evaluate information. A report containing information longer than one or two pages is typically routed to a staff person for evaluation and recommendation. This may not be what the author intended. Information targeted to upper management must be clear and very brief (one to two pages maximum) to receive consideration. This broad information would probably be of little interest to a mid-level manager or someone at the implementation level.
2. A mid-level manager responsible for pollution prevention implementation may not be interested in the specific details of a PPOA because he or she may not understand the particular application, chemistry, or process. His or her interest lies in the results and implications. However, another person at a different facility would be interested in the specific process details so as to evaluate whether the assessment is applicable to his or her process; he or she may also be interested in the actual details and background behind individual decisions and options.

The audience influences the means of information exchange. The audience must be willing, interested, and able to use the information exchange medium being presented. The audience must also be the group that can best apply the information being disseminated.

The present pollution prevention information systems are tailored to mid-level management, including pollution prevention managers and staff. The information includes policy and technical implementation ideas primarily disseminated at workshops and meetings. Information of a broader nature is printed in the *Pollution Prevention Advisor*, which is published monthly by DOE's Office of Defense Programs (DP). Neither of these mechanisms individually achieves complete information exchange for all interested parties.

Meetings are attended by pollution prevention managers and staff and authors of particular projects. However, these persons do not necessarily represent the detailed knowledge of all of the processes at a site. By the same token, a researcher or site worker will be familiar with the process he or she is responsible for but not those of the entire site. Mid-level managers can bring back ideas for others to develop further; develop policy and goals; and assist others in implementing ideas, concepts, and program.

Researchers communicate fairly well among themselves. They frequently see each other at meetings, talk over the telephone, or read each other's articles. This group communicates fairly independently within its field but not necessarily in the area of pollution prevention.

The supervisor-researcher-worker level does not have a good means of information exchange or communication among different sites. This is an important problem because the worker level is where ideas are implemented and frequently where innovative process changes begin. For example, mid-level management may require Freon recycling at the motor pool, but first-line management must determine the best way to implement this requirement.

This lower level of the organization is an often overlooked resource for pollution prevention ideas. Upper-level management assumes that PP/WMIN staff members represent and understand all of the capabilities and needs of the mid and lower levels. While staff members may have an excellent concept of function at these levels, they do not have a detailed knowledge of implementation or problems encountered in implementing program. An example of this might be implementation of a paper recycling program. PP/WMIN management understands the purpose, benefits, needs, and overall program but they do not understand the physical implementation problems and questions that, for example, the custodial force is faced with as it formulates the actual activities. The best solution to some custodial questions is to get the force in touch with someone who has overcome the problems already. Questions such as how often to pick up, size, type, and location of containers, types of paper, and separation techniques are best left to people who have actually implemented the program, not to a mid-level manager or staff person acting as the middle man.

Any information exchange forum or medium needs to reach down and incorporate the supervisor-researcher-worker level to achieve success. This audience is consistently left out of information exchange, even though it is critical to implementation and successful pollution prevention.

Any one communication system will not solve every need. The broad scope and brevity needed for upper management will not satisfy the workers' need for detail. The key is to choose a group of communication media that functions as a whole and reaches all levels.

The supervisor-researcher-worker level of the organization needs to become a more visible feature of the information exchange process. This level of the organization has ideas that can significantly affect process. It also evaluates ideas from other sources and

determines whether such ideas are applicable to local process. Most importantly, this level implements solutions. Two important actions need to occur:

1. Information exchange media, such as electronic or printed media, need to get to this level of the organization.
2. DOE/CSOs should consider workshops or meetings that are targeted to members of the implementer group. The effectiveness of getting small groups of implementers, such as facility maintenance, central shops, or electronics shop supervisors together to discuss pollution prevention in their individual work areas may seem costly, but the exchange of ideas will provide significant results.

One significant problem with getting this group together is the reluctance to send these individuals to meetings on the basis of the premise that there is no value in it. This could not be further from reality because the experience of this level of the organization is invaluable. These people know solutions to problems and can devise a means of implementing ideas when a concept is presented.

4 MEETINGS

Major programs or initiatives all have meetings that form a cornerstone to their efforts. For example, the power industry has the American Power Conference; analytical chemistry has the Pittsburgh Conference; nuclear energy has the American Nuclear Society Annual Meeting; and all professional societies have meetings. Presently, PP/WMIN does not have a nationally recognized meeting that combines both private and federal or state interests. Current meetings address specific needs; for example, the National Recycling Association meeting, the National Pollution Prevention Round Table, and DOE and Department of Defense (DOD) individual meetings. Furthermore, no one organization has developed a meeting that crosscuts the federal government.

In resolving its internal meeting needs, DOE has an opportunity to take a leadership role in the PP/WMIN national meeting area. This would meet two goals of the department: the internal goal of establishing effective PP/WMIN programs and the external goal of establishing a leadership role in this field.

The present meetings focus on policy and present limited concepts and activities that are being implemented at different sites. This is a very effective medium for PP/WMIN professionals and staff to network together, present new concepts and program direction, discuss successful programs, and reward achievement.

Meetings, workshops, and seminars transmit information via several formats: (1) formal presentations of ideas and concepts; (2) working group settings involving small interactive groups, possibly with a facilitator; (3) forums for open discussion with one's peers, commonly called "networking" sessions; (4) presentations by equipment and service suppliers who discuss the particular capabilities of their products; and (5) poster sessions involving presenters and interested parties.

A formal presentation is an effective means of presenting policy discussions, programmatic ideas, and research and development concepts to large audiences. This format allows for limited discussion and interaction among individuals and typically results in an exchange of ideas, papers, and potential future contacts among peers. This format also allows for limited discussion during or after sessions.

Working group meetings involve people intimately familiar with particular issues or processes who discuss various aspects of a limited topic. The meeting may be informal or facilitated and structured. Working groups are very valuable for considering specific meeting objectives. Two significant barriers to the success of this format are (1) the people necessary to make this format successful may not travel often and hence do not attend many meetings, and (2) the topic and objectives of the meeting must be carefully worked out in advance and the meeting organizer cannot let the group wander.

Networking sessions typically consist of a group of individuals with a common interest sitting down and talking "shop." This forum is very informal and may even take

place outside the formal structure of the meeting. This type of session can be very beneficial because it inevitably involves interested parties in an exchange of concepts. Interested parties can discuss at length anything they are interested in. This format is particularly valuable for people within a field because they have intimate knowledge of process, conditions, and needs.

Trade shows and vendor exhibits constitute a third method of transmitting information. These sessions are also very informal and are presented by people with a product to sell to potential customers. They provide an important opportunity to learn what is new and possibly applicable to an individual site. A second subtle component of this format is that good marketers are trying to sell but are also listening to what is needed. This is an important format for marketers to harvest ideas for future development.

The final format is the poster session. A presenter has a booth and posters or other props used to describe a new process, application, or idea. Interested parties of the poster session are encouraged to read the information and discuss the idea and its implications. The advantage is that it provides an open forum, without time constraints, to discuss application of an idea. While the total number of interested parties attending is usually less than that at a formal speaker session, the level of detail can be very extensive. This format allows a large number of presentations to be made in a short time frame. It has been used very effectively at the Waste Management conference. A significant disadvantage is that many speakers are reluctant to participate in this type of session.

DOE meetings typically employ formal presentations and networking. Vendor exhibits have been used but not extensively, and poster sessions have not been used effectively.

4.1 BARRIERS

The appropriate audience is essential to the success of a meeting. A policy meeting needs to have people familiar with implementation of concepts and development of ideas. Process implementers easily become lost in this format; the same can hold true in reverse for detailed workshops. The problem with most meetings is getting the appropriate people to attend and participate.

The attendance barrier can be complicated because meetings that target the supervisor-researcher-worker level may not be well attended. Management has preconceived ideas about the value of "losing" these people from their workplaces for the time of the meeting. This concern does not include the cost associated with travel and the per-diem. The solution to this barrier involves the commitment of time and resources.

The second barrier to successful meetings is scheduling. There are two significant problems with scheduling. The first is direct conflict among meetings. The second is time conflicts when the resources need to be used elsewhere; this occurs at budget time or during annual reviews or report writing. Several recent meetings have had conflicting schedules and

priorities. The problem becomes one of splitting the available audience. Examples include holding a low-level waste meeting the same week as an American Nuclear Society meeting, two meetings addressing decontamination and transition, and meetings with similar topics within several weeks of each other.

The solution to the second barrier involves meeting planners being aware of other meetings or activities that may affect their intended audience prior to scheduling. One technical society has solved this issue by requiring that all meetings or sponsorships be approved at the national level. In addition, a minimal amount of time is required between significant meetings that would draw from the same participant base. A common schedule of meetings may not exist within or without DOE. Potential solutions to this barrier would begin to appear if a common bulletin board/database system were adapted. Meetings could be entered on an open calendar, and conflicts could be avoided provided organizers use the database. A part of a DOE electronic information system could include a master schedule that would include all activities and meetings, including external meetings.

4.2 CURRENT MEETINGS

The DOE Office of Environmental Management (EM) (formerly the Office of Environmental Restoration and Waste Management) currently organizes the Pollution Prevention Conference, the single largest PP/WMIN meeting within DOE. This meeting is held annually at various locations across the DOE complex. This meeting is organized by a DOE chairperson and a support contractor. The contractor provides all meeting logistics and organizational input, including soliciting sessions, chairs, and papers, organizes sessions, develops an agenda, and finalizes proceedings. The meeting is held in the spring (April or May). The 1994 conference was attended by approximately 400 people. The format primarily consists of formal presentations in parallel sessions with minor vendor exhibits and poster sessions. The emphasis is on PP/WMIN policy, policy implementation, technology development, and program implementation. This meeting is well attended by DOE PP/WMIN professionals with involvement from research staff. Upper-level management may attend portions of the meeting but is rarely active in the whole meeting. A large percentage of PP/WMIN professionals support this meeting.

The DP has hosted semiannual technology workshops focusing on pollution prevention. These meetings are limited to approximately 150 participants and have a formal presentation format. The papers are solicited from a wide range of areas, including private industry and public administration. The audience primarily consists of PP/WMIN professionals from DP facilities but has also included other DOE organizations. This meeting used to focus on technology and information exchange; however, the focus and format have been changed significantly. Now the focus is on small working groups intimately involved in day-to-day process in different areas. The first meeting reflecting this new format was recently held at ANL and was highly successful.

DOE-EM formed the WMCCG in fiscal year (FY) 93; the group was formed from a small, select group of DOE facilities, including laboratories and production facilities, and

chartered with implementing the PP/WMIN program among DOE contractors. The original emphasis of this group was contractors helping contractors implement PP/WMIN program and acting as an occasional sounding board for DOE/Headquarters (HQ) ideas. The group has evolved away from contractors supporting contractors and moved toward a HQ support philosophy. This group has held several workshops addressing specific issues related to implementation of PP/WMIN program. Participation is limited to about 30 people and is by invitation. The format is facilitated open discussion.

DOE participates in the annual Waste Management Conference in Tucson every year. Recently, this meeting has begun to feature pollution prevention sessions.

DOE-Chicago (CH) formed the Research and Development Laboratory Working Group (RADWIG) in FY 92 to address particular needs within the DOE-CH laboratories. The organization consists of selected professionals from different laboratories that could combine their respective resources to resolve issues and problems. This group helped form a loose network of PP/WMIN professionals within the DOE-CH organization. This group has been expanded to include the DOE-Oakland facilities. Meetings and issues are coordinated by the DOE-CH Field Office, and the personnel involved are all technical professionals. The Office of Energy Research (ER-8) has used a subgroup of this organization to develop a network of pollution prevention professionals.

Other federal agencies, most notably DOD, hold meetings to discuss pollution prevention.

4.3 PRIVATE SECTOR

The private sector has been involved in pollution prevention and waste minimization much longer than the government. Because its approach is driven by profitability, it has taken very different routes to problems. For example, the Electric Power Research Institute (EPRI) has been very involved in reducing utility expenses and to that end has hosted, sponsored, and participated in many meetings. Other industries are very involved in technology development.

The private sector is involved in two types of meetings: (1) open meetings, such as those sponsored by the American Nuclear Society or Waste Management, and (2) internal company meetings among representatives of different facilities. The private sector participates in most meetings with the purpose of either looking to buy or sell information, process, or technology. Process people developing process changes are typically very careful about disclosure of ideas or secrets because of the potential impact to profit and competition. The presence of individuals at the worker level at these meetings can be very helpful.

The private sector has used internal meetings of PP/WMIN or process professionals to review processes and opportunities for improvement. These meetings allow for frank detailed discussions that frequently go into process detail and potentially proprietary aspects

of production. The 3M Company uses meetings of this nature to improve process and competitiveness.

State governments are beginning to develop pollution prevention programs and meetings. The meetings tend to focus on local issues and opportunities and can be very worthwhile. DOE sites can learn new techniques, develop new opportunities for technology transfer, and interact with state and local governments, thus, showing a positive side of having DOE in the community. Industrial trade shows constitute another area for DOE participation. Technology interchange between industrial companies and DOE can enhance DOE pollution prevention efforts as well as provide markets for DOE technology development.

4.4 RECOMMENDATIONS

4.4.1 Audience

The present meetings are targeted to PP/WMIN professionals and other professional staff and interested researchers. Individuals from the supervisory or engineering levels do not attend in great numbers. A forum for this group needs to be created to take advantage of its great knowledge.

4.4.2 Planning

Meetings need to be carefully planned by professionals. Locations and timing can be very important to the success of any meeting. More important than logistical planning is technical planning, particularly for limited workshops and smaller meetings in which it is easier for participants to get off track. The desired product of the meeting must be carefully planned and the actual meeting controlled to keep sight of goals and objectives. Meetings and workshops that are well planned should identify specific end products. For example, a technical workshop to discuss information exchange must have specific goals at the planning stage, and these goals must be adhered to as the meeting proceeds.

4.4.3 Future Meetings

DOE should continue the present PP/WMIN Annual Meeting in a format similar to its current format. The meeting is well attended, and many PP/WMIN professionals see this forum as essential to the program. The following modifications should be considered, however:

1. The roles of federal and state governments as well as other stakeholders should be expanded to include other elements. Participation by other groups such as DOD and EPA should be encouraged. This could be accomplished by asking them to host sessions at the meeting and to be

responsible for session speakers. As the program becomes more successful, other stakeholders could be included. Reciprocal participation in DOD and EPA meetings should be expected and encouraged.

This meeting could become a very important meeting in the pollution prevention field through careful expansion. This would also begin to fulfill a DOE vision of leadership in this arena.

2. The program should be similar to those of technical societies. Technical societies divide their meetings into two basic functional parts, the technical portion and the physical arrangements portion. These two portions are managed separately. The technical program is managed by a technical program chairperson. This person is responsible for the technical program, including selecting topics, sessions, and speakers, the call for papers, setting the program and the agenda, and getting the agenda and abstracts to the physical arrangements coordinator. The physical arrangements chairperson, typically a professional meeting person, is responsible for the meeting location, all facilities and rooms, meeting announcements, registration, and facilitating the meeting. The physical arrangements should be contracted to an organization that is familiar with running a meeting of this size.

If the DOE meeting were modified in this way, the Waste Reduction Steering Committee should be involved in selecting and approving the technical chairperson, topics, and meeting location. Ideally, these planning and approval steps would occur at the previous annual meeting. The chairman would then select technical session organizers/chairs to develop specific sessions for the next meeting. The session organizers and session themes would be selected and approved very early in the process. The organizers, in turn, would solicit papers and topics from their associates. Prior to the meeting, the technical chairs would meet and conduct a final session and paper selection, and the agenda would be set and published. A contractor would be in charge of the actual meeting logistics. Sessions that highlight late breaking policy can always be planned, and speakers selected late in the process.

The advantages of dividing the PP/WMIN Annual Meeting into a technical and a physical arrangements portion would include the following:

- a. The meeting would be planned well in advance, including the theme, topics, schedule, and location. Session chairs could solicit and develop papers and sessions early in the process. Abstracts could be reviewed and a complete agenda published prior to the

meeting. Potential attendees could see the agenda and plan to attend.

- b. This type of format would involve more people in the planning and execution process. The diversity created by the new involvement would generate enthusiasm and ideas for the program and serve as an information exchange process in and of itself.
 - c. The present rush to get the meeting organized would be avoided. The planning effort could be spread out over a longer period and be less disruptive of individuals' schedules.
 - d. A formal call for papers would generate more papers on a wider range of topics than in the past.
 - e. A meeting that is well planned would attract participation from other groups or organizations such as DOD, the EPRI, EPA, states, and other stakeholders.
3. The formal paper format of the conference should be expanded to include poster sessions that feature prominent PPOAs and implementation. This type of format would allow greater discussion among interested parties about specific PPOAs. The real value of a PPOA is when it is communicated and implemented by other groups. The type of discussions that most favor rapid development of a successful idea occur in detailed conversations that do not generally occur in formal sessions. The poster session format should be tried as a means of encouraging idea development.
 4. Long-term planning should include evaluating the desirability and need for booths sponsored by vendors. The booths could potentially defray expenses for the meeting. This option should be evaluated as the meeting and audience grow.
 5. The PP/WMIN is primarily a policy meeting attended by PP/WMIN professionals. In the future, the meeting should be expanded to include members of the supervisor-researcher-worker level.

4.5 DOE-SPONSORED MEETINGS AND OTHER WORKSHOPS AND MEETINGS

The DP semiannual technology workshop has historically presented papers on a variety of important topics. The concept of micro-experimentation was introduced at one of these workshops. This forum changed its format with its fall 1994 session. The workshop featured small, facilitated working groups of technical experts primarily from the lower level of the organization discussing pollution prevention in their particular fields and areas of

responsibility. This was the first time DOE attempted to bring the supervisor-researcher-worker level together to develop pollution prevention program.

This type of meeting should be expanded to include as many topics as possible. Each workshop should feature a number of topics, and the topics should change from workshop to workshop. Every effort should be made to encourage facility (laboratory or production facility) management to send people to these sessions. A critical measure of upper-level management's willingness to support this type of conference will be the visibility of results from the sessions. Meeting notes or minutes and follow-up reports need to be very visible.

The small sessions featuring subject matter experts are very similar to the TQM teams currently being used by Motorola. These types of meetings need to be opened up to as much of the DOE complex as possible. The present sponsorship and development by DP is appropriate and should be continued.

The DOE-CH RADWIG meetings have served the function of addressing specific issues and policy implementation. This group has met infrequently and the topics of discussion have been very specific. This is also an excellent forum for a limited audience with a very defined purpose. This forum could be used or adapted to address specific issues. The Energy Research ES&H meetings have a similar function. Pollution prevention sessions have been held to develop specific issues relevant to Energy Research. Both of these meetings have provided valuable exchanges on limited topics to a limited audience. This group has been effective at accomplishing specific limited goals and could be used to benefit the DOE PP/WMIN program by focusing on very specific topics, as was done in response to the hazardous waste moratorium.

Other workshops such as the WMCCG can be important for solving specific problems or issues. A potential format might include groups from laboratories and production facilities or research and development and defense programs. The concept of a contractor group dedicated to bringing contractors together to solve contractor problems can be useful if it is closely adhered to. Contractors frequently have questions and concerns about implementation of policy or program and development of program that can be resolved by open discussion among contractors. This type of forum can be very useful for fleshing out the key issues in development and implementation. The most important criterion for this type of forum is that it must address specific problems and issues that are within the contractors' expertise. Workshops that address the development of policy are not within the limited scope of a contractor group. The audience for these groups should not be limited to specific sites. Such a group needs to focus very carefully on the desired outcome of the meeting and the meeting should be conducted so that the outcome is achieved.

The focus of this group has evolved from contractors supporting contractors to more of a HQ support organization. If this group is to continue its focus on HQ support, the structure of the meetings and output must be changed to reflect this in order to be of use to others. HQ issues are very limited in focus, and any meeting developed to explore this type of issue must be structured and run accordingly. The desired outcome must be accurately defined in advance, and participants must be prepared to discuss the relevant issues in detail

before the meeting. The meeting must traverse a specific path and participants must not be allowed to wander.

DOE is a sponsor, cosponsor, or a participant in a significant number of other meetings that provide valuable information exchange opportunities. These include the Waste Management Conference at Tucson, the American Nuclear Society meetings, National Recycling Association meetings, the DOD Pollution Prevention Conference, and many others. DOE should use all of these meetings to learn what other groups are implementing. They are also an excellent forum for DOE to demonstrate its success stories outside of the complex. Participation in these meetings as speakers and as audience should be encouraged, as appropriate. This recommendation should not be interpreted as encouraging development of a cadre of professional meeting goers but rather as encouraging attendance when the topics and papers are of interest and can be useful to local program.

5 PUBLISHED MEDIA

Published media represent an excellent means of communicating within the pollution prevention area. This mechanism, if used correctly, can be used to overcome troublesome problems with communicating PP/WMIN concepts to all levels of management.

One of the most significant problems PP/WMIN, or any other program, faces is getting the attention and ultimately the endorsement of senior management. The upper layers of the organization have a large audience competing for access, thus access is limited. PP/WMIN ideas need to get to upper management for several reasons:

1. Program endorsement, buy-in, and support drives "culture" and must come from the top.
2. Senior management needs to visualize what PP/WMIN is and its successes. Seeing results at other facilities is important.
3. Senior management is always impressed with seeing its own site getting positive publicity.

Publications can be very effective at making the communication link to senior management if they are well written, short, and relevant to the sites or problems. The best way to achieve this is through a newsletter that has short articles, a format conducive to browsing, and that can easily be copied and sent to other managers. A senior manager's note on a newsletter is often interpreted by first-line managers as explicit direction for action.

At the other end of the spectrum are workers looking for specific ideas that can affect their processes. They browse through a newsletter looking for relevant articles, read the article, and start asking questions of their peers. Thus, the article has accomplished the first major hurdle, the reader has engaged brain. After asking some questions, the worker will look for additional information from the author of the article. This process starts a cultural and process change in motion.

5.1 TYPES OF PUBLICATIONS

Publications can be grouped into journals, magazines and newspapers, and newsletters. Each of these groups can be further divided into DOE/government and commercial/industrial.

5.1.1 Magazines and Newspapers

A number of magazines feature commercial recycling and pollution prevention. Municipal waste streams and occasionally some hazardous streams constitute the principal focus of this medium. Magazines and newspapers provide an excellent opportunity to look

for specific equipment ideas, review current events, and plan activities. DOE does not contribute heavily to these periodicals but does use them as resources for information.

5.1.2 Journals

Currently, only one journal — the *Pollution Prevention Review* — is published in the pollution prevention area. The journal has a wide variety of articles and, again, represents an excellent resource.

5.1.3 Newsletters

Several commercial newsletters are published in the pollution prevention/recycling field. These publications focus on pollution prevention and waste minimization in municipal waste and associated issues. Most newsletters are expensive to purchase, and in the commercial field, represent an excellent but limited resource.

DOE Defense Programs publishes a monthly newsletter, the *Pollution Prevention Advisor*. This newsletter is the only periodical that addresses DOE waste streams: high-level, transuranic, low-level, hazardous, and nonhazardous. The focus of this periodical is implementation not policy; it has a distribution of approximately 5,000. The newsletter features short articles from across the DOE complex and addresses all of the relevant pollution prevention topics. The *Pollution Prevention Advisor* is mailed to laboratory directors, and copies are distributed to principal managers. This periodical is widely read, well received, and focuses on problems and solutions that are important to the DOE community. It is frequently redistributed around ANL with questions about the status of implementation of a specific idea.

5.2 OPPORTUNITIES

Published media represent an excellent opportunity to communicate with many levels of the organizational structure. The principal advantages of a periodical are that it (1) contains a wide variety of articles covering many different topics; (2) represents an easy form of one-stop browsing; (3) can be read anytime anywhere, there are no constraints such as being at the meeting, time, place/location, or waiting for abstracts or searching through a computer file; and (4) is an easy way to get a message to senior management as well as provide useful information to the lower and mid levels of an organization.

A message communicated to the top of an organization must be short, clear, and concise and ideally something that can be read at leisure. Two media can potentially fill this need; letters and an effective periodical. Letters, however, are not an effective means of communicating with a large audience.

5.3 BARRIERS

The principal barriers to published media are distribution, competition or generation of articles, and funding/cost. The funding/cost and distribution issues work against each other. Most of the higher cost newsletters received in Environmental Management Operations at ANL are read or browsed by managers but hardly ever find their way to workers. An effective newsletter must be subsidized to keep the cost low. Preferably, it should be free. The advantage of a free newsletter is that it is easily sent to a very large audience and readers do not need to resubscribe or pay fees. This means that more people will see and at least browse the work. If the newsletter has a subscription fee, readership will not be as large or as effective simply because neither the worker nor people with a casual interest will subscribe.

The most significant barriers for newsletters are sources for articles and competition for articles. An effective newsletter needs to have a consistent source of good articles.

5.4 RECOMMENDATIONS

DOE's needs are different than those of American industry, hence the typical commercial publication will not address all issues, or more importantly, all waste streams. DOE needs to have an internal publication in the pollution prevention and waste minimization field. Such a publication would be the quickest and cheapest method of communicating with the largest cross section of the DOE complex. DOE should encourage individual organizations to use the *Pollution Prevention Advisor* published by DP for developing specific issues and programs and discourage the development of any competitive newsletters for the following reasons:

1. The *Advisor* already has a large and expanding readership;
2. New newsletters would dilute the base of available articles, thereby limiting the quality and number of available articles;
3. New newsletters go through a break-in period during which they must establish themselves in the market; this is a long, difficult, expensive process in terms of resources and funds; and
4. Some authors will argue that they have a unique message to a unique audience, but any message worth saying should be communicated to the widest audience in order to achieve widespread acceptance.

Because this newsletter is expanding to include more of the DOE complex, the *Advisor* could be published by DP for DOE.

A partial list of publications received by the author's office includes the following:

Corporate Environmental Strategy, The Journal of Environmental Leadership, PRI Publishing, 32B Warnick Place, Metuchen, New Jersey 08840.

Material Matters, Illinois Recycling Association, 9400 Bormet Drive, Suite 5, Mokena, Illinois 60448.

MSW Management, Forester Communications, 216 East Guiterrez Boulevard, Santa Barbara, California 93101.

Pollution Prevention Advisor, DOE Defense Programs and Systematic Management Services, 1000 Independence Avenue, Washington, D.C. 20585.

Pollution Prevention Review, John Wiley & Sons, 605 Third Avenue, New York, New York 10158.

Resource Recycling, Resource Recycling Inc., 1206 N.W. 21st Avenue, Portland, Oregon 97209.

Solid Waste Digest, Chartwell Information Publishers, 805 Cameron Street, Alexandria, Virginia 22314.

Solid Waste Management, Office of Solid Waste Management, School of Public Health, University of Illinois, 2121 West Taylor Street, Chicago, Illinois 60612.

Solid Waste Report, Business Publishers Inc., 951 Pershing Drive, Silver Springs, Maryland 20910.

World Wastes, Argus Business, 6151 Powers Ferry Road, Atlanta, Georgia 30339.

6 ELECTRONIC MEDIA

The advent of the personal computer and the development of new, powerful software has made electronic databases, networking, and communication the way of the future. Recent developments in software and hardware have made distributed information systems both practical and effective. An electronic information system could be a very valuable tool for implementing PP/WMIN ideas.

6.1 CURRENT SYSTEMS

The EPA PIES, DOE EPIC system, and DOE WIN were reviewed during preparation of this report. Because the DOE EPIC system was being developed at the time, it received a detailed review. The PIES system and the WIN system are currently in the process of being phased out or are not functional.

Staff members at the HMX have recently reviewed the following electronic media: the EPA PIES, an electronic bulletin board system (BBS); WIN, a communications network; and the DOE EPIC. The results of this review are presented here.

6.1.1 EPA PIES

The EPA developed the PIES in 1988 to "promote source reduction and recycling through information exchange and technology transfer." The PIES consists of four mechanisms used to distribute information: a library, an electronic BBS, telephone headlines, and outreach efforts. The PIES was developed to help government, industry, national laboratories, and the general public exchange information on various aspects of pollution prevention, including initiating prevention programs, developing research, and implementing industrial regulations.

6.1.1.1 Advantages

A great deal of information is dedicated to pollution prevention. The information on the PIES is well organized, presented in an easy-to-find fashion, and divided into "mini-exchanges" and "doors." Each mini-exchange is dedicated to a specific subject area and contains bulletins that relate to the subject. These bulletins are available for viewing and downloading (i.e., electronic transfer from the main system to the user). Each door is also focused on a specific subject, but the material is organized in a database fashion. The material can then be viewed by doing searches on specific criteria.

The software utilized for the BBS is user-friendly and offers help screens throughout the sessions. The software has the capability of notifying users of updated bulletins.

The PIES is accessible to anyone. Users register the first time they log on and choose a password for future logins. It appears as though users receive full use of the system upon initial registration and have the capability to upload (i.e., electronic transfer from the user to the main system), download, and read and leave messages. Uploads are not available to others until they are reviewed by the system operator (SysOp).

Access to the system is available in several ways. Users may connect by dialing directly into the system through a commercial telephone line. The PIES is also available through a data network subscription service called SprintNet. This service allows users to subscribe to the service and then connect to PIES through a local rather than a long distance number.

The PIES is part of an umbrella that links the system to four other BBSs: the United Nation's Environment Programs (UNEP), Industry and Environment Programs Activity Center (IE/PAC), International Cleaner Production Information Clearinghouse (ICPIC), and the UNEP Ozone Action Information Clearinghouse (OAIC). These are international systems that allow PIES users to communicate with overseas peers without incurring great costs. These systems share a message base, and several of the file areas are also linked together. Upon initial connection, the user chooses which system he or she would like to login to and then proceeds. Each system controls its own user base, which allows for greater security.

6.1.1.2 Disadvantages

Many of the bulletins do not have dates. Consequently, it is difficult to tell how recent the article may be; users may be reading outdated regulations. While some bulletins list the date the article was placed on the system, this is inconsistent throughout the BBS. File size is also not available to the user until downloading is attempted. Therefore, users are not able to predetermine how long the transfer will take. It would be preferable if the list of files available for downloading contained both the file size and the date of the file.

SysOp support seems inconsistent on the system. While reviewing the system, public messages addressed to the SysOp were posted for several weeks before they were read and responded to. Also, on-line SysOp assistance is not available to users. However, the technical assistance telephone line was answered promptly by the SysOp, and questions were answered in a knowledgeable and professional manner.

The PIES has not fully utilized technical advances to its greatest advantage. Although the information is useful, the system does not keep the user's attention. Currently, the highest baud connection rate is 2400. While the slower baud rate may combat some technical problems novice users may incur in connecting, the more advanced user will be impatient at the connection rate and time it takes for menus to appear on the system. Many other BBSs operate at a variety of baud rates to accommodate both types of users.

The system does not utilize graphics or colors, which would also keep the user's attention. The menus are boring, and while they serve their purpose, it would be a great improvement if creativity were utilized.

6.1.1.3 General Comments

The PIES is organized and contains a great deal of information. Updating existing capabilities would greatly enhance the system. Currently, while the EPA considers major revisions of the PIES, the system is inoperative.

6.1.2 DOE WIN

The DOE WIN was developed through the DOE Hazardous Waste Remedial Actions Program (HAZWRAP) Support Office to promote technology transfer throughout DOE and to support environmental restoration and waste management activities.

6.1.2.1 Advantages

The system was originally set up to provide DOE employees and contractors with a centralized "information management tool." The system currently includes capabilities for electronic messages and data transfer, bulletin boards, and information systems. As referenced in a September 1990 users guide, plans are in place to include capabilities for spreadsheets, graphics, and on-line conferencing. The ideology behind this system is logical. Users would only have to connect to one system to have access to a variety of general office software needs and to be able to communicate with DOE personnel around the country.

Users can create files on the word processing portion of the system and then print them out locally, save them, or transfer them to others on the network via the electronic message transfer system. They can also enter the bulletin board portion of the system, read a bulletin that references a second bulletin, leave a bookmark at the spot in the first file, access the second, and go back to the first bulletin at the marked spot. The information contained in the BBS is current and easy to find.

Also in place is an area called the Interrupt Menu. This area contains a calculator, planner/calendar, distribution list directory, and provides access to mail.

6.1.2.2 Disadvantages

Today's office workers and managers use a variety of software packages such as Lotus, WordPerfect, and Procomm. Capabilities similar to the ones these software packages provide are currently available or will be available on WIN. In the meantime, it is much more efficient for staff to use software they are familiar with, which frequently includes Windows capabilities, rather than learning a whole new system. The only worker WIN might

benefit is one who has had no outside experience with the more popular types of software and learns only WIN. This type of worker is uncommon and would fall behind when communicating with sponsors and nongovernmental personnel.

Many of the commands include a combination of keystrokes. Users press either the control key, while simultaneously pressing another key to perform a function, or press the gold key (a key that varies according to the type of computer the user is on), release it, and then press a second key to perform the function. The commands are inconsistent and would be difficult to remember. Often the proper keystrokes are not listed at the bottom of a menu. For example, the screen may tell a user to "press the EXITSCREEN key to exit," but does not indicate which key that may be. The user is unable to advance until he or she deciphers which is the EXITSCREEN key. Also, in some instances, a menu may appear that gives the user a choice of commands. After choosing an option, only half of the screen is erased, leaving a portion of the original commands listed. However, these commands cannot be used. This is confusing and frustrating for the inexperienced user.

In addition, upon entering the database portion of the system, the system displays a screen that should contain a list of databases to view, but the list is empty. The directions at the bottom say to choose a database. Because there are no databases to choose, previously used key commands that are not listed on the bottom are the only way to exit the database portion.

The area that could be very useful is the Interrupt Menu. However, this option is not listed on the menus and instead is found through a reference in the users guide. This type of situation occurs frequently. Today's users refer to users guides as a last resort. Operators should make their systems friendly enough so that guides become secondary to on-line instructions.

Users may not access the system until they have registered. The registration process involves submitting an application to the SysOp and then upon approval, receiving an assigned password and user ID. The delay involved may cause users to look elsewhere to solve their specific needs. Many network services and BBSs allow on-line registration with limited initial security that is increased within one day if the user meets the required criteria.

The DOE WIN system also has a maximum connection rate of 2400 baud, which could be greatly increased.

6.1.3 DOE EPIC*

The DOE EPIC was developed to provide an exchange of pollution prevention information throughout DOE. The system is now in the test phase and is being originated

* Since the time this report was written, DOE EPIC has been upgraded. Information on this update can be found in the Appendix.

as a multiple system that ties in with other DOE pollution prevention databases and applications. The system has been divided into four areas: bulletins, electronic mail, a calendar area, and database programs. Access to the system is available through a registration process. Upon registering, users are given a user ID and sent a software package. This package provides connection through a modem to Energy Research's Wide Area Network (WAN), and users are then linked into the EPIC system. Users who are already connected to the WAN may login directly.

6.1.3.1 Advantages

Office registration provides added security to the system. By providing communication software to users, the burden of providing support for numerous software packages is lessened. Providing software also allows the users' systems to communicate at preset, uniform settings, which allows greater speed and fewer difficulties with connections and file transfers.

The EPIC is extremely easy to use. Although it utilizes a popular BBS software system, it has been customized such that the most novice user can find information with little difficulty. Users are given a list of all available choices of commands at each prompt. Commands that are entered that are not available are disregarded. Expert users of the BBS software may use some software-specific commands that can be used rather than the automated commands of the system.

The information is well organized. The user can move through the bulletin area through a series of menus that become more detailed at each level. While reading bulletins, users may download the file immediately or download it in a batch of files later in the session. The file names are provided in the introduction area of each file to provide assistance in batch downloading.

Calendar information is stored in a door that allows for searches on the month and year of conferences and then lists the events during that time frame.

The database program portion shares "document abstracts" and "case studies" with the EPA PIES. Searches can be done on text or by key words. Search results can be downloaded.

6.1.3.2 Disadvantages

The system does not currently have a large number of users. Therefore, preregistration and software distribution do not require the effort that a larger system would demand. As the system grows, it may be advantageous to evaluate other forms of registration, such as on-line registration.

The system has been fully customized to meet the needs of DOE, including topic layout and bulletin access. While this setup provides ease of use, it may become difficult to expand or alter the system as those needs evolve.

Users move forward through menus and submenus by selecting numbers. Users move backwards through the use of the Q command, one submenu at a time. The system should have an option to move directly back to the main menu in one step.

Searches in the database portion of the system may result in a number of documents. If a user wants to download these search results, all of the documents must be downloaded, rather than any one of the documents that resulted from the search.

It does not appear that calendar information can be downloaded. While these files may not be too large to read on-line, users would not want to have to write down pertinent information related to a conference that interests them.

6.2 OVERALL ADVANTAGES OF ELECTRONIC MEDIA

The principal advantages of electronic media include the following:

1. The user has immediate access to available information, including the originator of the information.
2. Readers/users can communicate with a large audience to address a concern. A user can solicit opinions from many sources and evaluate different responses. An electronic information system has the advantage that the user can put a query into the system and get responses from different sources and practical information all in a short period of time. Electronic media can provide a response in hours or days in contrast to months for printed media and perhaps years for meetings.
3. Reports and other information, such as data sheets, regulatory information, funding information, and process waste assessments, can be communicated effectively and quickly. The user can query the system, filter out irrelevant information, and use all of the necessary information.
4. Electronic media are not resource intensive, yet a large amount of data can be stored and accessed. Printed media of all types have the distinct disadvantage of only being available if one knows where to look. Electronic media can be queried by key words or phrases, thus eliminating the need to catalogue data and sort through many different sources for the piece of information of interest. The need to mail or send information overnight can be reduced or eliminated.

5. Resources are shared for different uses; computer systems are not purchased solely for information exchange.
6. Most reports, waste assessments, and other information are currently prepared via computer software. This information can be readily transferred from one computer file to another and to an information network relatively easily.
7. Detailed schedules of events can be maintained and updated regularly. One of the most significant problems DOE has is different organizations scheduling events at the last minute and without information about conflicting activities. No comprehensive schedule of events exists. Electronic media would be an excellent means of publishing and updating a living schedule of events. Project managers attempting to schedule events or meetings would be able to consult and review a comprehensive schedule before attempting to schedule an event.

6.3 BARRIERS

The following are the principal barriers to electronic media:

1. An information network is susceptible to security issues. Data on an open or unsecured network are susceptible to being read and distributed by people other than those for whom they are intended. Information can be taken out of context and distorted in ways that could cause significant additional work or negative publicity.
2. While many people in the DOE system have access to a PC and to network software and may be connected to Internet or other major networking systems, the audience base and computer access must be expanded to include more people at lower levels of the organization. It may be helpful for a PP/WMIN engineer to have access to the information, but the real advantages come when the worker has access.
3. Awareness and training must be accomplished to familiarize users with the system and make them proficient in the use of the equipment to achieve the best results for their particular application.
4. The system must have a long-term philosophy and funding commitment. Two of the major reasons why the EPA PIES failed were funding philosophy and commitment. For an information system to be effective, system management must be able to plan for future needs.
5. System management must be done carefully and professionally. Articles need to be reviewed and system use needs monitored in order to avoid abuse.

6.4 RECOMMENDATIONS

ANL has reviewed several existing information exchange systems and considered the needs of an electronic information exchange for DOE. Its recommendation is to proceed with the DOE EPIC. However, ANL believes several considerations should be taken into account by DOE. With the resolution of some key issues detailed below, a DOE PIES analog (i.e., EPIC) could provide the type of information exchange DOE requires.

ANL reviewed the EPA PIES and the DOE WIN. The review of the EPA PIES was positive. The PIES is easy to access and user-friendly, two of the most commonly requested attributes. DOE's WIN system is difficult to access and use. Another option is to have ANL develop and operate an electronic BBS for DOE. This would be similar to the HMIX, which ANL currently operates for the Federal Emergency Management Agency (FEMA) and the Department of Transportation. Since considerable effort has already been expended on the development of a DOE EPIC, it appears to be the system of choice.

On July 26, 1993, ANL met with staff of Science Applications International Corporation and Pacific Northwest Laboratory to discuss the EPA PIES. At that meeting, it was assumed that DOE had already decided to use the DOE PIES and planned to have a prototype up by the fall of 1993. The prototype would be based on an EPA PIES upgrade and be in testing for one year. ANL subsequently talked with the system operator for the EPA PIES who could not attend the July 26 meeting. Currently, the EPA is considering development of a follow-on PIES system. Scheduling and funding for such a project have not been determined. This leaves DOE with two options: (1) wait for the proposed new PIES to be developed or (2) proceed with the present DOE EPIC. Waiting for a new EPA PIES would be of no benefit to DOE.

If DOE becomes a part of the EPA PIES, ANL believes that several questions or areas of concern should be addressed.

1. The very statement that the DOE bulletin board will become a "part" of the EPA PIES implies that DOE will have little, if any, control over the system. Care should be taken to be sure of consistent funding for the "parent" system and also that the system is headed in a direction consistent with DOE objectives. Will DOE have any say in the way in which the system is configured and maintained?
2. The second area of concern is system security. A multitude of sophisticated computer users spend time doing nothing but breaking into systems. The system software **must** be capable of providing security at several different levels within the system. The system operator **must** be capable of knowing how and if the system can be entered by unauthorized people. If access will be through the Internet, significant restrictions should be placed on the configuration files and the File Transfer Protocol (FTP) capability. Anonymous FTP allows anyone to enter the system and transfer files. File transfer is the primary way in

which computer viruses are spread. The need for security must be balanced with the goal of wide and easy access.

3. A third consideration is system integrity. All information contained within the system should be verified prior to posting, kept current, and removed when outdated. Provisions should be in place to allow only authorized people to add or modify files. What integrity checks will be made on the EPA PIES data that are to be transported to the DOE local area network (LAN)? Once again, virus checking should be done prior to placing files on the DOE LAN.
4. System hardware and software need to be considered. Is the DOE PIES platform compatible with the EPA PIES hardware? The proposed work plan dated June 25, 1993, mentions taking into consideration "constraints of the DOE LAN." Consideration also needs to be given to the existing hardware, in terms of whether or not there is enough disk space to hold the files. How much space is required?
5. The EPA system operator has already mentioned the evolution of the system into a "paperless office," with graphical interfaces, CD-ROM, a FAX service, and video tape library. These will cost money. Is DOE going to be included in the planning phases or just billed?
6. Training is another area to consider. System operators need to be trained on how to manage the software and hardware. In addition, many times users request training. Provisions should be considered for both training and marketing of the system to new users.
7. The ultimate goal of this system must be to become a useful component of futuristic technology. The system should become a part of the worldwide web of electronic communication.

None of these areas of concern warrant recommending the use of PIES. Much of the work is already under way for the DOE EPIC system. These considerations have been outlined for planning purposes with the hope of reducing some risks.

Electronic information systems can solve many of the technology transfer and information exchange needs that DOE faces. The electronic medium is an excellent vehicle for interchange between the middle and lower levels of the DOE complex. That is, senior management will not find electronic media particularly useful because it does not have time to browse and will not look for solutions to specific problems; it will, however, delegate this responsibility to others. Middle management will find the system useful from the beginning because it can browse, communicate, review reports, browse PPOAs from other sites, and review other information available. The lower level or worker level will find electronic communication very useful because it can look for specific answers to limited questions. As

more people obtain access at lower levels, electronic information systems will become increasingly more valuable.

DOE should develop an electronic communication system using the EPIC system currently being tested by Energy Research. The system needs significant enhancement, including expansion of information fields, readership, and access capability, but it is an excellent start. The following should be taken into consideration as the EPIC system is being developed:

1. **Financial Commitment:** DOE must commit to a long-range approach to the system. Funding must be available on a multiyear rather than on an annual basis. Multiyear funding allows system managers to train operators, supply operator assistance, plan equipment changes, add to the system, and add to capabilities in an orderly manner. This funding must have a high priority so that system managers can count on funding levels two or more years in advance.
2. **Software:** State-of-the-art computer software changes very rapidly. For example, when this report was started, Mosaic was not even heard of, now it is state-of-the-art. Because of the rapid changes and time frames involved (it is assumed that at least one year lead time will be necessary before a fiscal commitment is made to a new system), no one software can be recommended. Software should be evaluated by the principal programmers and be state-of-the-art when the system is written.
3. **Content:** Several important areas can be improved in the content area of the networks. A criticism of the PIES is that the system contains articles without dates. In fact, a general criticism concerns the way articles are handled. A good system has some control of articles, contributions, and communication in general. This is done to avoid junk articles, harassment, and other forms of inappropriate information on the system and to provide some means of deleting obsolete information from the system. Finally, control must be exercised because of hackers and viruses.
 - a. Centers of excellence should be established at various sites to review articles and develop/solicit articles. For example, Allied Signal is the recognized expert on PPOAs. It could be a center of excellence for coordinating and reviewing PPOAs. Other sites could be centers for green manufacturing, decontamination and decommissioning (D&D), national laboratories, outreach, construction, etc. This should be a small responsibility at any one site, certainly no more than a fraction of a full-time equivalent (FTE) (0. or 0.2%).
 - b. System operations should be such that system security can be maintained, including security against the inadvertent computer

hacker but also against industrial espionage. While some DOE work is performed in the public light, for example, work with specific cooperative research and development agreements (CRADAs), other work, particularly in the defense arena, should not be visible to the general public or world market.

- c. The system should be used to transmit regulatory information and guidance information. Currently there are two problems with regulatory information:
 - i. The field is often requested to comment on new or proposed legislation or guidance. Because the path for this request involves many stops — the field office, area office, and internally within the facility — the time needed to review and supply meaningful comments or information is so restricted that the response is typically useless. An electronic medium that would allow rapid transmission of information would be able to bypass the intermediate stops and get the information directly to the field; requests and direction for comment could follow.
 - ii. Elements within the field organization or the lower tiers of the organization do not have access to regulatory information, and written information may not be the latest available. A data system that contains at least the national requirements would be very beneficial for PP/WMIN and for achieving compliance.
- d. The system should contain very powerful search capabilities. The user must be able to search key words, phrases, topics, etc. The advantage is that individuals can conduct detailed searches to determine what is available, who is doing what, the regulatory impacts, and other valuable information.
- e. The system should contain a list of contacts within the PP/WMIN field that is kept current.
- f. The system should contain a database that lists current PP/WMIN activities, such as who is doing what PPOA and what the proposed time frame for completion is. This would reduce duplication of effort.

7 CONCLUSIONS AND RECOMMENDATIONS

Pollution prevention and waste minimization in a large organization such as DOE require both vertical communication among upper, middle, and lower management and horizontal communication across levels of management of different operating units. Historically, DOE has limited communication across organizations. However, the Department's mission is changing from one of weapons production to one of environmental restoration. This transition requires a heightened degree of communication from the top down and across individual program elements. DOE has used meetings and workshops, infrequent publications, and a newsletter to communicate in the pollution prevention field, and these methods have achieved varying degrees of success. None, however, has been completely successful at meeting all of the individual needs of the DOE community.

Vertical communication is more difficult to implement because the needs of upper, middle, and lower management are so dissimilar. Senior management has very little time; communication must be brief, to the point, and eye-catching. First-line managers, on the other hand, will communicate among themselves when the avenues of communication are opened.

A barrier to communication is competition for available resources in a field in which resources are limited. Pollution prevention organizations should work together and not compete against each other. Meetings must be well planned so as not to coincide, and they must be focused and not have overlapping subjects. Groups wanting to publish their ideas should join together and focus on making a single publication more effective rather than forming competing publications.

The following recommendations are offered to assist PP/WMIN in establishing an effective communication system:

1. Centers of excellence should be established at different sites to provide clearinghouses for the latest information in a specific area. For example, Allied Signal at Kansas City is a center of excellence for PPOAs, and Argonne-East is a center of excellence for decontamination applications. These centers could act as libraries of the latest technologies, as sources of articles and information for publication, and as evaluators of new ideas.
2. DOE should establish a calendar clearinghouse to coordinate events that DOE either sponsors directly or participates in significantly.
3. DOE should hold an annual meeting for pollution prevention professionals. The meeting should focus on policy and broad-based ideas that can achieve wide acceptance at many sites. The meeting should be planned well in advance, thus allowing a long lead time for development of papers; the format of the meeting should follow that of professional societies.

The meeting should be expanded in a controlled manner to include other government entities, DOD and EPA in particular; states and tribes; other stakeholders; and private industry. First steps can be taken by involving DOD or EPA in the planning process and asking them to sponsor individual sessions, including presentation of papers.

The meeting format should be expanded to include poster sessions in the PPOA area; vendor exhibits should be expanded to include public, government, and private vendor presentations.

4. Defense Programs recently changed the format of its semiannual Pollution Prevention Technology Workshop to focus on pollution prevention in the first-line supervisory area. This change in focus is very important because emphasis at the "grass roots" level will generate new networks among those actually responsible for doing the work. Frequently, workers have the most ideas, are most familiar with the process, know what needs attention, and also have an excellent concept of what will (and will not) work.
5. Other meetings should be sponsored and sanctioned only when the end justifies the specific means.
6. DOE should expand and support the *Pollution Prevention Advisor*. This newsletter reaches all levels of management and provides ideas for pollution prevention. Consolidating information in this newsletter would allow it to be seen by all levels of management. The level of detail is such that senior management can read and grasp concepts, and first-line managers can determine what has to be done and whom to contact.
7. DOE should continue support for the EPIC system and develop this program into the premier electronic communication system in America. The current system should be developed with state-of-the-art software that is very flexible so that it can support long-term growth. The system should be developed with the cooperation of other federal agencies, including EPA and DOD.

A long-term approach should be used in developing the EPIC system. Funding should also be looked at long term so that system operators can conduct planning and development within a reasonable time frame and so that the project will be able to retain experienced personnel.

The system should be staffed by professionals in the database and network field and supported by professionals in the pollution prevention area as well as DOE centers of excellence.

APPENDIX:

U.S. DEPARTMENT OF ENERGY ENERGY POLLUTION PREVENTION INFORMATION CLEARINGHOUSE UPDATE

A.1 INTRODUCTION

The U.S. Department of Energy (DOE) Energy Pollution Prevention Information Clearinghouse (EPIC) system has recently been updated and placed on-line as an Internet-based, World-Wide-Web server, accessible through Mosaic. This graphical system has been greatly improved in the areas of flexibility, movement through the system, eye-appeal, and extent of information.

After the user connects through the Mosaic interface, the system issues a prompt for a login name and password or allows the user to login as "public," which provides restricted access. A user may request registration information at this time. The "public" account was used for this evaluation.

A.2 ADVANTAGES

Users connect through the Internet, which allows for a faster and clearer connection than a modem-accessible system. Also, rates are reduced because telephone costs are not incurred. However, the modem-based system is still accessible to accommodate users who may not have access to the Internet.

Since users may connect through a generic login, they can get a feel for the system and determine if it meets their needs without going through the registration process.

Upon entering the system, the user sees a list of new and updated bulletins and conference listings. This allows greater efficiency when using the system because the user does not need to search each topic area for possible new information. Bulletin listings provide date and size information, which allows users to obtain the most recent data. Users may view bulletins on-line, have the items E-mailed to them, print the items, or choose Save from the Mosaic menu to store the bulletin.

Flexibility in moving through the system has been greatly enhanced. For example, users may go back to the Main Menu at any time during the session and are given the option of additional menus at applicable locations.

The system is linked to other pollution prevention and recycling information systems. Movement through these systems is fluid, without prompts for additional login information or error problems. The links allow users to access information that the EPIC system staff may not have the resources to reproduce.

A.3 GENERAL COMMENTS

The most novice user will find the updated DOE EPIC extremely easy to operate. The information is timely and of interest to a wide audience of individuals involved in pollution prevention and recycling information. No disadvantages were found during this evaluation.

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