POLLUTION PREVENTION CASE STUDIES: IMPLICATIONS FOR ARMY INSTITUTIONAL PROCESSES

AEPI

Army Environmental Policy Institute

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ABSTRACT

This analysis of case studies of specific pollution prevention actions at seven Army installations addresses institutional factors, rather than applicable technologies. Reviewing records and field interviews produced data on both institutional facilitators and inhibitors to change.

This work examines the interplay of factors in management, funding, motivation and procurement. It also objectively demythologizes some phenomena and conditions often subjectively claimed to exist by partisans who provide no evidence for their assertions.

Policy suggestions are presented for improving strengths and alleviating weaknesses based on the data.

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CONTENTS

ACRONYMS

AAPPSO	Army Acquisition Pollution Prevention Support Office
AEC	Army Environmental Center
AEPI	Army Environmental Policy Institute
AFAR	Army Federal Acquisiton Regulation
ALAP	Acquisitions Law Advisory Panel
AMC	Army Materiel Command
ANAD	Anniston Army Depot
ATCOM	Aviation Technical Command
AVCRAD	MSARNG's Aviation Classification and Repair Depot
CAA	Clean Air Act
CCAD	Corpus Christie Army Depot
CTX	Center for Technical Excellence
DEFAR	Defense Federal Acquisition Regulation
DESCOM	Depot System Command
DMWR	Depot Maintenance Work Requirement
DOC	Directorate of Contracting
DoD	Department of Defense
DOL	Directorate of Logistics
DRMO	Defense Reutilization and Marketing Office
ECIP	Energy Conservation Investment Program
EFAR	Engineering Federal Acquisition Regulation
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
FAMC	Fitzsimmons Army Medical Center
FAR	Federal Acquistion Regulation
GOCO	Government Owned, Contractor Operated
GOGO	Government Owned, Government Operated
HAZMIN	Hazardous materials and waste minimization
IWTP	Industrial Wastewater Treatment Plant
LATP	Lima Army Tank Plant
MAAP	Milan Army Ammunition Plant
MACOM	Major Command
MANTECH	Army Manufacturing Technology
MSARNG	Mississippi Army National Guard
NOV	Notice of Violation

ACRONYMS

NPDES	National Pollution Discharge Elimination System
NRDC	National Resources Defense Council
OFL	Optical Fabrication Lab
OMB	Office of Management and Budget
PECIP	Productivity Enhancing Capitol Investment Program
PIF	Productivity Investment Funding
QRIP	Quick Return on Investment Program
SOH&E	Safety, Occupational Health and Environmental Division
TACOM	Tank Command
TQM	Total Quality Management
TRI	Toxin Release Inventory
WMCA	Waste Minimization Capitalization Account
WREAFS	Waste Reduction Evalutaions at Federal Sites

1 INTRODUCTION

Independent pollution prevention initiatives and programmatic development began several years ago in the Army, either as hazardous materials and waste minimization (HAZMIN) or as preemptive compliance actions. These initiatives provide a rich area of experience to be mined as the Army endeavors to strengthen its environmental program and prepares to respond to future requirements that will spring from the Pollution Prevention Act of 1990 and from states' pollution prevention regulations.

The Army Environmental Policy Institute (AEPI) examined pollution prevention activities at seven Army installations to illuminate key success factors as well as obstacles. The search criteria placed equal value on discovering both the positive and negative influences of institutional, managerial, social, resource and similar factors.

The overall purpose of this study is to provide the Army Secretariat with options to modify current policy (should that be indicated) and shape future policy. A subordinate purpose was to provide empirically derived information and options to complement the relatively "theoretical" bases in law and regulation that have driven policy formation to this point. Thus, the study rechecks assumptions and claims put forth by pollution prevention partisans, and examines initial policies that had to be formulated quickly.

1.1 LITERATURE REVIEW OF CASE STUDY METHODOLOGY

The original investigation plan called for an independent consultant to study five Army pollution prevention initiatives and report the findings to AEPI for further analysis. The natural question arose, "What case study model should be used?" The team conducted a literature search to examine models other studies had used; those results are summarized here.

1.1.1 UNCERTAINTIES: ADMINISTRATIVE PROCESS STUDY

Harold Stein (1951) recognized the inherent impossibility of proving firm laws concerning human behavior, especially when faced with economically practical sample sizes. Jitendra Singh, interpreting Stein, wrote about the necessary uncertainties that must be accepted when studying administrative processes (Singh, 1962). He listed five assumptions which fit the topic of this study and the "honest broker" role of AEPI:

- Administration is a complex process that needs detailed and accurate handling by the case-writer to get the feel of actual participation in the action.
- Absolute causal relationship cannot be asserted. We can nevertheless observe repetitive patterns of behavior, and on that basis formulate tentative hypotheses about similar administrative action.
- The case is concerned with answering the question "what" happened and "how" it happened — not with the question "why" it happened.
- There are so many uncontrolled variables in a situation involving human beings, it is not possible to establish general laws of administrative behavior.
- There is no one right way of doing things. Public administration cases can only help us to realize the complexity of administration and indicate the infinite ways of tackling administrative problems.

Other writings discussed by Singh seem to idealistically imply there will be a discoverable best answer to any human process issue.

1.1.2 STUDYING DIVERSE CASES

A Rand Corporation paper (Yin, 1975) addressed how to handle information from diverse sources when conducting a secondary study of independently prepared cases. Though this paper focused on the problems encountered when data from unconnected case studies are combined into one analysis, it also implied a warning about the problems of combining data from very similar case studies: identical questions that are addressed to varied situations are likely to yield non-comparable responses.

1.1.3 CO-ANALYSIS OF SIMILAR STUDIES

A cluster concept for integrating findings of separate studies is available to justify co-analysis of studies that are dissimilar (Light, 1971). The cluster approach was originally offered as a paradigm for legitimately combining the findings of disparate statistical studies. It sets a conceptual

framework for a disciplined analysis of context and process information from different settings.

This approach identifies differences as they affect the apparent correlations to reality, and discourages blind reliance on numerical or quasi-numerical calculations. Many times, a qualitative analysis of relationships and variables demonstrates that apparent statistical relationships are irrelevant or improbable. However, with the cluster approach, discordant findings can be seen as being equally valid outcomes of locally specific situations.

1.1.4 SUMMARY VIEW OF SUCCESSFUL PROJECTS

Eleven major corporations conducted, analyzed and reported pollution prevention projects. A recent report about these projects, *Total Quality Management: A Framework for Pollution Prevention* (CEQ, 1993), provides a summary view of relevant technical, institutional and procedural problems and solutions. That report gives generalized insights on issues, approaches and outcomes involved in conducting successful pollution prevention projects and programs. While providing interesting findings (which largely agree with those of this AEPI study) and illustrating a case model presentation format, the Commission's report does not provide a formula for conducting the case studies themselves.

1.1.5 OTHER REFERENCES

Additional readings listed in the reference section of this paper provide a variety of ideas and cautions that are helpful in developing a study approach and a report style, but do not provide a clear selection of alternatives.

1.1.6 RESULTS OF THE LITERATURE REVIEW

Most case study work is directed at forming anthologies of cases to teach a particular subject or share a singular experience. The review showed that this project would require a protocol to ensure consistency and thoroughness, yet cope with the intended variability of future situations.

1.2 OVERALL PHILOSOPHY/APPROACH

After evaluating the models identified in the literature search, the team concluded that no case study model for pollution prevention policy exists; a new approach would be required. Therefore, this study project should be viewed as being somewhat exploratory, with the possibility of deeper study later.

1.2.1 FOCUS OF THIS STUDY

The pollution prevention literature is replete with cases describing the bright side of technological changes that paid for themselves handsomely in terms of environmental protection, public approval and dollars. This case study analysis was not designed to look at the technology or paybacks except as they are needed to explain or illustrate an institutional process or situation. Nor is it intended to be an inspection of local situations to stimulate local correction. Rather, it examines the institutional framework and processes that affect identification and implementation of pollution prevention projects.

1.2.2 RANDOM SELECTION NOT USED

The combined AEPI and consultant team decided not to randomly select cases for the following reasons:

- Statistical validity, even if attainable, would be more expensive than warranted.
- Random choice of trivial cases would result in wasteful effort.
- Diversity of cases could be attained by deliberate selection.
- A degree of randomness would occur in the patterns and combinations of factors involved in each case.
- True randomness would be unattainable, anyway, owing to incomplete data bases from which to draw candidates (i.e., incomplete listings of successes and almost no listing of failures from which to make the random selections).

1.2.3 CASE STUDY OVERVIEW

Seven sites were selected, and one of those sites had two projects. Table 1-1 lists the sites by names and acronym, and gives a brief description of the pollution prevention aspect of each one. Locally specific observations are not offered in these discussions, as this study is not intended to be an inspection of local situations to stimulate local correction. Fuller summaries of the seven cases are included in Appendix A.

1.3 SIGNIFICANCE OF FINDINGS

Clearly, this study is not an exhaustive compilation of relevant comparative data. It does not allow one to analyze the statistical significance and predict the frequencies with which various beneficial and detrimental phenomena occur at all Army facilities and activities. Nevertheless, the

TABLE 1-1
POLLUTION PREVENTION SITES INCLUDED IN STUDY

INSTALLATION	COMMAND	PROJECT
Anniston Army Depot (ANAD)	AMC	Cadmium waste reduction through metal plating process change
Corpus Christi Army Depot (CCAD)	AMC	Reduce chromium waste through change in Aluminum coating process
Fitzsimmons Army Medical Center (FAMC), Optical Fabrication Laboratory (OFL)	HSC	Decrease heavy metal waste by switching from glass to plastic lens production
Fort Lewis	FORSCOM	Develop installation pollution prevention plan
Lima Army Tank Plant (LATP)	AMC	Change weld inspection technique to replace ozone depleting materials
Milan Army Ammunition Plant (MAAP)	AMC	Reduce explosuve-laden water through recirculation and a change in vacuum systems
Mississippi Army National Guard (MSARNG), Aviation Classification and Repair Depot (AVCRAD)	ARNG	Reduce solvent wastes by changing to plastic media blasting for paint stripping
Mississippi Army National Guard (MSARNG), Mobilization and Training Equipment Site (MATES)	ARNG	Reduce maintenence wastes by using a new fuel filtering system

occurrence of phenomena at one or more of such a small sample of locations implies that they are probably relatively common throughout the entire Army. Therefore, their expanded application or alleviation should be of general benefit to the Army Pollution Prevention Program and to basic missions.

Many of the observations made in this paper are reaffirmations of conditions that have been widely recognized for many years. Thus, this

paper's findings and suggestions for policy action might be expected to elicit a range of reactions:

- Old hat, nothing new.
- Too hard, laws and regulations are too hard to change.
- They already have the authority, get on with it!
- There is no money, take it out of your hide.
- They will never change, live with the problem.
- Too personality-driven for broader application.
- Sounds interesting, try it.

No matter what the reaction, the opportunity and need still exist to correct negative conditions. The authors are aware, for instance, of work already underway to word-search and ultimately liberalize military specifications to add flexibility for using recycled materials and for substituting low hazard materials for high hazard ones (Terrell, 1993). The fact that this study reports a need for such action emphasizes the correctness both of the policy decision and of the effort to modify the specifications.

Since the case study team has no vested interest in outcomes, the analyses and options are reasonably objective; that is, not punitive, self-seeking, or apologetic for long-standing situations.

1.4 DETAILED APPROACHES/METHODS

Gathering data involved several preparatory and substantive activities: identifying a candidate list, developing an interview protocol, and assigning personnel to the study.

1.4.1 CANDIDATE LIST PROPOSED

Life Systems, Inc., as consultant, informally surveyed knowledgeable Army personnel to form a candidate list, screened the candidates to find the richest possibilities, then presented to AEPI ten cases appearing complex enough to yield interesting policy insights and for which information and key players appeared to be accessible.

Candidate case sources could not suggest failures for profitable study. This fact might be attributed to an understandable reluctance of involved persons to discuss potentially embarrassing "nonevents."

AEPI staff reviewed short write-ups and picked five of the ten for detailed study. AEPI and the consultant decided that two additional cases were worthy of inclusion because they added to the diversity of cases and had considerable potential for involving significant institutional issues.

- The Lima Army Tank Plant (LATP) case came to light before the consultant's contract went into effect. It served first as a test of the interview protocol and of insights that might help in conducting the other case reviews. It also resulted in useful changes to, and an affirmation of, study assumptions. Follow-up contacts at Lima resolved the data gaps that resulted from protocol design errors.
- The Fitzsimmons Army Medical Center (FAMC) project was unique in two major respects: it is a medical facility (no others were represented in the long list of candidates first screened by Life Systems, Inc.) and had been part of a pollution prevention activity involving a regulatory agency.

1.4.2 INTERVIEW PROTOCOL

A guiding protocol had to be developed owing to the lack of models and the need to tailor the protocol to the special characteristics of the Army milieu. AEPI staff prepared an interview outline (Appendix C) that appears deceptively simple. This protocol also served as the structural outline of the case summaries from which this paper stems, resulting in considerable consistency and parallelism between the bodies of information collected and the case write-ups.

1.4.3 CASE STUDY PERSONNEL

Life Systems, Inc. assigned one person to do its contacting, field work and report drafting. AEPI had two contact/field work persons backed up by a team leader and an analysis assistant. Each case involved a first contact, pre-reading of basic documentation (largely provided by the respondents), a 1-2 day visit for on-site interviewing and further documentation gathering, ad hoc recontacts for clarification, and drafting and internal review of the case write-ups. The entire contact period was about a month long, except in the case of FAMC, where contacts stretched over about two and a half months.

1.4.4 SOURCE ANONYMITY

Case study interviewers assured participants of anonymity to the extent of not putting respondents in a negative light that would cause problems to them or to other identified individuals. However, "accountability" exists to permit information to be rechecked or expanded, should the need arise.

1.5 READING THIS PAPER

Findings from the seven case studies fall largely into four easily definable categories: Management, Funding, Motivation and Procurement. Therefore, four chapters of this report treat those subjects in considerable detail. Several smaller clusters of findings appear under the subject "Other Factors." They are important in their implications, but either did not individually generate enough information to warrant separate sections, or deserve additional emphasis.

Findings are aggregated from the various cases and discussed as sets, with only enough reference to individual cases to highlight special situations and to give credit for innovative action.

Policy suggestions are offered throughout each of the four single-focus chapters and summarized in broad form at the end of each one. Chapter 6, "Other Factors," does not readily lead to a final, unified summary; each section of Chapter 6 contains its own suggestions.

1.6 PROCEDURAL FINDINGS — LESSONS LEARNED

As a result of this study, the team has two recommendations for similar work in the future.

1.6.1 TEAM EXPERTISE

In retrospect, had the consultant and in-house teams included business management expertise, many of the questions would have been framed differently to elicit more penetrating answers regarding systemic management factors. The team's preponderance of engineering expertise does not negate its utility, but input from a management discipline might have accomplished the product more easily and with greater thoroughness.

Team expertise is a potentially critical factor for any future policy studies that are intended (or likely) to evaluate or affect management processes and culture.

1.6.2 GESTATION TIME

In general, respondents were open when discussing the processes and relationships that facilitated and hindered achieving their respective pollution prevention activities. However, some leads could not be pursued to their ends, and some suspicions could not be verified. Allowing researchers more time to build trust and a chance for respondents to refresh their memories could result in more detailed descriptions of the precise forces impeding and facilitating action.

Field work, including first contacts, spanned only about a month for most of the cases. A period of perhaps three months, with two or three on-site visits, might have been better. (In 1951, Stein observed that information is lost with the passage of time — "historical fading" — and recommended that studies should be designed and conducted to counteract this natural effect.) The team recommends that future case study investigations span a longer time period, for overcoming historical fading and lessening the inhibitions of installation personnel.

2 MANAGEMENT FACTORS

This chapter examines the various relationships involved in the case study projects to identify the management factors that are most important in developing pollution prevention programs and those that suggest beneficial policy options with wider applicability.

An "ideal" management structure for pollution prevention programs might have the installation commander chair and fully support a steering committee which would, in turn, oversee a pollution prevention coordinator (SAIC, 1993). This person would identify, develop and coordinate the activities of pollution prevention teams. The SAIC model may be broadly adopted in the future, but the cases in this study had a variety of different administrative structures — only one of which included a designated pollution prevention coordinator. The organizational structure of the pollution prevention component at each site is discussed in separate sections of this chapter.

The location of pollution prevention programs within the installation organizational structure, and the personalities involved at each level, influence the extent to which the program is reactive or proactive in its waste reduction activities. These cases revealed that installation command, environmental staff, and workforce are the main levels of involvement; each is examined to explore its impacts on pollution prevention programs.

2.1 INSTALLATION COMMAND

Support from Installation Command is crucial for any undertaking on an Army installation. Command endorsement of pollution prevention efforts greatly increases the attention they are given and their likelihood of success. Motivation for commanders to support pollution prevention programs varies by instance, but may develop from environmental Notice(s) of Violation (NOVs), concern about waste disposal costs, encouragement from higher command, or a personal interest in environmental stewardship. These motives are discussed more thoroughly in Chapter 4.

2.1.1 SPECTRUM OF COMMAND LEADERSHIP

Installation Command actively supported pollution prevention initiatives in five of the seven cases. A commander in the Mississippi Army National Guard (MSARNG) showed extraordinary support by designating himself as the point of contact on pollution prevention matters. The commander at Anniston Army Depot (ANAD) declared environmental compliance as his first priority and fully supported pollution prevention as a means to achieve and maintain compliance. The command at Corpus Christi Army Depot (CCAD) differed by providing distant support for environmental initiatives that included pollution prevention, taking no active role in its promotion. CCAD environmental personnel requested more visible command support, but even without that they were able to work productively across directorates on pollution prevention programs.

Commanders also influence program success through the amount of autonomy they give program managers, the extent to which they encourage other support staff to cooperate, and the attitude about pollution prevention they convey to installation personnel. Pollution prevention is only part of larger environmental programs in most cases, and the amount of attention a commander can devote to all environmental issues varies by the type of installation and environmental demands. However, a strong statement from command encouraging pollution prevention initiatives can provide valuable support to a program at any installation.

2.1.2 COMMAND CHANGE POSES PROBLEMS

The commanders' interests at ANAD and MSARNG helped define their environmental and pollution prevention programs. When an installation commander is reassigned, the arrival of a new commander with different priorities can cause significant adjustments in the installation's environmental efforts. Commanders who are concerned only with compliance issues that emerge during their watch, rather than building institutional capacity for long-term pollution prevention program effectiveness, interfere with project success — whether intentionally or not.

POLICY SUGGESTION *One way for the Army to promote consistently strong environmental programs would be to stress the importance of pollution prevention and waste minimization in commander training and on commanders' performance appraisals.*

2.2 PROGRAM STRUCTURE

The organizational structure and location of environmental and pollution prevention programs also influence the potential for minimizing waste. Army installations produce hazardous waste in many areas including maintenance, industrial production, and material management. Pollution prevention initiatives can impact waste production in all of them, and pollution prevention programs that reach throughout an installation increase chances of realizing maximum reductions.

Environmental offices generally concentrated on the details of meeting environmental compliance, and they often lacked resources to actively pursue pollution prevention options unless those were directly related to compliance. Their ability to sustain a pollution prevention program depended in part on program structure, staff composition and access to information. These factors varied between installations and depended on the installations' activities, size, commander interests and other influences.

Either industrial management or maintenance divisions at installations managed six of the pollution prevention programs studied for this report, with pollution prevention duties assigned to someone in the environmental office as an additional responsibility. Each installation had some type of committee to oversee environmental office activities.

An Environmental Quality Board chaired by the installation commander guides environmental efforts at Anniston Army Depot. ANAD's board determined that maintenance operations were contributing a significant amount of pollution to the industrial wastewater treatment plant, so they developed an environmental support branch within the maintenance directorate to address the problem. Providing the new office with a specific focus and placing it both organizationally and physically within the focus of operations relieved the Environmental Management Division of that responsibility, and freed it to provide better support to other areas of the installation.

At Corpus Christi Army Depot, as at ANAD, an Environmental Quality Board chaired by the installation commander guides environmental efforts. Until recently, CCAD organized pollution prevention functions through their environmental coordinator. Reorganization at CCAD has switched the responsibility for pollution prevention to environmental engineers in the Safety, Occupational Health and Environmental Division. A friendly working relationship exists between the environmental coordinator's office and the environmental engineers, but the environmental coordinator no longer has administrative authority and the engineers control their own programs. No single person is designated as pollution prevention coordinator.

Fort Lewis is the only installation of the seven that has a pollution prevention manager to coordinate pollution prevention efforts; however,

the pollution prevention office is part of the Environmental Engineering Branch, and manpower shortages force the pollution prevention manager to spend the majority of her time on compliance-related issues.

Washington state law mandates a pollution prevention plan. This makes the situation at Fort Lewis unique, and provides pollution prevention initiatives with more support than they might otherwise get. Even so, the Directorate of Contracting (DOC) refused to process the contracts to develop the Pollution Prevention Plan, which meant an outside agency had to be used. Then, pollution prevention projects that were generated by the Directorate of Engineering and Housing ran into roadblocks at DOC. (This is discussed in more detail in Section 5.6.)

Inter-directorate collaboration efforts are underway at Fort Lewis to remedy these problems; the pollution prevention manager and the inspector general recently initiated a Hazardous Materials Process Action Team composed of representatives from several directorates. This type of action is promising.

Mississippi Army National Guard has one central environmental section in the Facility Management Office that provides environmental support to many of the installations. Some installations, like Fort Shelby, have their own environmental offices that initiate pollution prevention programs. At MSARNG's Aviation Classification and Repair Activity Depot (AVCRAD), the work foreman heads the environmental efforts and meets quarterly with a committee. The AVCRAD commander distributes responsibility to allow those directly involved with issues to make decisions about them. This greatly contributes to a sense of project ownership and helps identify the most appropriate solutions.

A consistent pollution prevention organizational structure has not yet developed. Corpus Christi Army Depot and Mississippi Army National Guard operate fragmented programs, while Fort Lewis is pulling everything under one manager. The two Government-Owned Contractor-Operated (GOCO) facilities have no formal programs or opportunity identification process. A Draft Army Pollution Prevention Plan Manual (SAIC, 1993) recommends a preferred structure for pollution prevention programs incorporating top-down support, a pollution prevention steering committee, a pollution prevention coordinator and working teams. Perhaps a common structure will evolve in the future.

2.3 COMPOSITION OF THE ENVIRONMENTAL STAFF

The processes and the people involved in procedural change greatly influence chances of success. Technical program managers initiate pollution prevention changes in response to perceived needs and to pollution reduction directives of higher command. These managers establish their own reduction priorities depending on available information, time and

financial resources, and they often rely on the installation workforce for reduction suggestions which might come to light because of education and awareness programs. These programs aim to create a better understanding of the waste producing processes employees operate. Because environmental managers also rely on technical developments, they need time to keep abreast of new technology that can affect installation hazardous waste streams.

Pollution prevention and environmental needs vary among installations. As a result, objectives for pollution prevention programs are set at various levels. Each installations' program success depends in part on the amount of time available for pollution prevention. The time available is largely determined by the size and type of environmental staff. A shortage of technical personnel tends to keep the focus on compliance, while a shortage of administrative personnel limits time spent on justification forms, support needs and pursuing funding options.

Before their recent reorganization, Corpus Christi Army Depot's environmental office consisted of five administration personnel and ten wage-grade employees responsible for actually handling the hazardous wastes; the environmental coordinator estimated that an additional 25 people were needed to fulfill the office's responsibilities. The administrative staff developed training programs and coordinated funding for pollution prevention developments, but for technical work they borrowed manpower from the Industrial Engineering Division in a different directorate on a per-project basis. The engineering staff gradually assumed responsibility for industrial pollution prevention projects and now controls them with assistance from the coordinator, as needed. This new structure matches skills with needs, but removes organizational control from the environmental coordinator.

CCAD noted a problem keeping skilled technical staff while GS-12 level pay caps exist; respondents for each case in this study expressed the need for a larger environmental staff. Successful preventative programs require adequate staffing of environmental offices.

POLICY SUGGESTION

The minimum environmental office staffing requirements for pollution prevention activities should be sufficiently flexible to allow a range of options for the various types of installations. Include pollution prevention manager positions as part of minimum staff requirements at installations, and allow them to focus on pollution prevention rather than compliance issues.

2.4 INFORMATION COLLECTION AND MONITORING

New technology is an important source of information for pollution prevention projects. However, given heavy workloads, it is always difficult for technical managers to keep up with technology. Army Materiel Command Depot System Command's (DESCOM) Center for Technical Excellence (CTX) program, in addition to financial assistance, provided both Anniston and Corpus Christi Army Depots with ideas that have been successful at similar installations. Generally, DESCOM seeks solutions for specific problem areas, but unsolicited information about new reduction opportunities also can initiate changes.

MSARNG identified an opportunity through an unsolicited sales demonstration. At CCAD, engineers who attend conferences and trade shows write reports on technology that might affect their operations, then distribute these reports to technical sections at the installation; this practice has stimulated several projects.

Previously employed technology is another valuable source of solutions. Both Lima Army Tank Plant and Milan Army Ammunition Plant modified technology they had used years before. LATP's contract specified the older technology as an option, so they experienced no difficulties gaining approval for the change. MAAP needed only to make slight modifications to equipment used years before in order to meet current safety standards. Recording information on older technologies and tapping into the experience of the long-term work force are additional sources of pollution prevention project ideas and solutions.

POLICY SUGGESTION *Strengthen existing systems and develop new systems for disseminating information on pollution prevention methods, case studies, and new technology.*

Widely disseminated information on pollution prevention case studies and new technology applications is an effective way to alert environmental managers of new opportunities. Unfortunately, for offices lacking full-time pollution prevention personnel, time to review new information will remain short.

2.5 GOVERNMENT-CONTRACTOR DIFFERENCES

At Lima Army Tank Plant, problems arose due to standard contracting language which was crafted when mutual interests in pollution prevention were not evident. Management structure and responsibilities defined in the contract meant the government was unable to provide new equipment needed in order to gain a compliance benefit from the reduction of volatile emissions. According to the agreement, the contractor was responsible

for equipment acquisition; however, the contractor would not have implemented the change except for the accidental and incidental financial benefit.

POLICY SUGGESTION *Identify areas of mutual interest between the government and contractors, and implement contract wording changes (generic and contract-specific) to empower both parties to easily undertake mutually beneficial projects and activities in pollution prevention.*

2.6 ROLE OF THE WORKFORCE

The workforce holds great potential for identifying pollution prevention projects. Total Quality Management (TQM) ideas reinforce the notion that long-term intimate exposure to real aspects of the production, maintenance or other waste-generating procedures provides employees with knowledge to make significant contributions toward waste minimization efforts. Most of the installations utilized suggestion programs, often in combination with rewards, for useful or cost saving ideas. Excluding the workforce or failing to adequately communicate pollution prevention goals and objectives led to misunderstandings and employee resistance at some installations, as discussed below.

2.6.1 INCREASE EMPLOYEE AWARENESS

Anniston Army Depot provides a good example of top-down support for pollution prevention programs. ANAD's program includes every employee at the installation and gives the workforce a strong sense of project ownership. Difficulties with NOVs at their industrial wastewater treatment plant prompted the instigation of employee tours of the depot's production process, to educate employees about waste generation at the depot and how their combined activities contributed wastes to the treatment plant. This effort, combined with additional education and suggestion programs, proved very successful at getting the workforce to identify opportunities for reducing treatment plant wastes. By clearly articulating waste problems and making employees more aware of waste generation issues, ANAD was able to reduce wastes cited in their NOVs as well as additional, nonhazardous, water and energy waste.

2.6.2 EMPLOYEE RESISTANCE

It is worth noting that both Lima Army Tank Plant and the Optical Fabrication Lab at Fitzsimmons Army Medical Center experienced resistance from their employees on pollution prevention projects due to

a lack of communication regarding the projects. In both cases, the employees were concerned that the changes were intended to reduce the workload and number of employees rather than to reduce and eliminate wastes. Once the employees understood the pollution prevention objectives and realized their jobs were not threatened, they became supportive. At least two lessons can be learned from this situation:

1) Bringing the workers into the pollution prevention program structure early can prevent potential conflicts.
2) Employees may withhold ways to reduce waste because they fear the improvement could reduce the workload and thereby decrease the number of required personnel.

POLICY SUGGESTION *Stressing the importance of reducing environmental costs, rather than workforce costs, may enhance the feeling of security among the workers, lead to their "buy-in" of the program, and encourage them to provide new ideas for waste minimization.*

2.6.3 LEADERSHIP ROLE OF LONG-TERM EMPLOYEES

The Milan Army Ammunition Plant and the Mississippi Army National Guard cases shared a key facilitating element: each had a pair of long-term employees involved in their respective projects. These were people with enough organizational maturity to work past the obstacles that threatened their projects.

The other case histories did not expressly discuss this point, but did identify experienced professionals as key protagonists.

POLICY SUGGESTION *Promote the use of organizationally mature persons in leadership roles for pollution prevention activities. Avoid placing such responsibility on the shoulders of inexperienced junior personnel.*

2.7 SUMMARY AND SUGGESTIONS FOR POLICY DEVELOPMENT

In all seven cases, the primary management factors for the success of pollution prevention programs were command support, program officer dedication and contributions from the workforce. The degree of activity by and among these groups set the parameters for pollution prevention program development, implementation and effectiveness. Open communication, cooperation and workforce education can stimulate new suggestions and smooth the contentious misunderstandings that are endemic to changing situations.

The cases have provided some general points to consider when reviewing management linkages. These are offered below as policy suggestions that could be implemented individually or in combination:

- Encourage command support for pollution prevention programs and initiatives through commander training and on commanders' performance appraisals.
- Establish unequivocal minimum staffing criteria for pollution prevention, and standards that adequately address the additional demands of a pollution prevention program or project(s). Allow flexibility for valid local differences. For example, a National Guard installation probably cannot support a dedicated pollution prevention proponent, but an installation such as Fort Hood probably needs more than one.
- As part of minimum staff requirements at installations, include pollution prevention manager positions. Enable that person to focus on pollution prevention rather than compliance issues by providing sufficient administrative personnel to handle paperwork, and by not giving the pollution prevention manager too many additional duties.
- Build a sense of employee ownership in pollution prevention programs. Management responsiveness to suggestions from the workforce and installation-wide education and awareness programs will encourage teamwork.
- Encourage commanders to assign "organizationally mature" individuals to leadership/ mentor roles in the installation's pollution prevention program.
- Strengthen existing systems and develop new systems for disseminating information on pollution prevention methods, case studies, and new technology.
- Identify areas of mutual interest between government and contractors, and implement contract wording changes (generic as well as contract-specific) to empower both parties to easily undertake mutually beneficial projects and activities in pollution prevention.

3 FUNDING FACTORS

The ubiquitous issue of funding inadequacy is not new to the field of pollution prevention. Rather than analyzing funding in a direct way, this section focuses on the impact of the attitudes, criteria and procedures that influence the funding of pollution prevention activities, as revealed by the seven cases reviewed. To ensure that the repeated issues can be seen from different perspectives, this section repeats certain problems and concepts that also are covered under other main headings.

3.1 DECISION-MAKING CRITERIA

Funding influences intrude into many aspects of pollution prevention projects and activities. Competing needs limit the availability and quantity of funding. Congressional, Department of Defense (DoD), Army and Major Command (MACOM) "actions at a distance" often erratically combine to affect timing and timeliness of installation spending authority. Additionally, the source ("color") and availability of funding can make or break an action.

Most traditions and formal strictures controlling the flow of funds to and through organizations arose from very reasonable and precisely defined origins. They had (and have) the specific benefits of saving money, promoting the wise use of money and preventing fraud. Owing to the intricacy of government or any other large enterprise, the intended benefits are often hard to realize, but the accumulated accidental detriments seem to occur all too easily. Thus, the following discussion derives more from the multiplied and interwoven effects of real and unintentional impediments than to any blame or obvious errors.

Various experiences in pollution prevention activities suggest that the Army needs to rationally and deliberately relax numerous crunch points. "One size fits all" approaches to funding criteria and management, as they relate to each other and cut across external and internal procurement and other regulatory boundaries, make for briar patches of impossibilities with only occasional patches of feasibility. The word "frustration" best characterizes the issues that surround the topic of funding.

3.1.1 COMPLIANCE PROBLEMS

Among the seven cases, responding to compliance problems — whether resolving or forestalling them — was the single most consistent funding decision driver. It was central for five of the cases and an important secondary consideration for the other two. One might argue that reliance on the compliance threat gambit occurred only as a practical strategy for getting funds. Nevertheless, real compliance issues were (or soon would be) involved. A review of the data indicated that fear of compliance requirements was THE driver, despite many good words about environmental stewardship and the value of volunteering.

Expanding federal and state legislative and regulatory action and executive policies are making pollution prevention itself a compliance field. Thus, compliance is likely to become even more explicitly the funding decision driver. The Army may wish to explore implementation policies and procedures needed (or needing adjustment) to bring appropriate aspects of its pollution prevention program under the compliance "must fund" umbrella. This appears to be an area ripe for current, rather than future, development.

3.1.2 COST WEIGHED WITH COMPLIANCE

These cases showed that the cross-play of cost and compliance considerations was a mixed bag. Only the FAMC, LATP and MSARNG cases were funded primarily on the basis of their potential for tangible cost savings, but they also involved considerable supporting influence from the compliance issues. For example, FAMC greatly accelerated the search for fixes when they discovered that the installation's hazardous waste costs were jumping 50 percent (+$180,000) as a result of one problem process. The other cases certainly included potential cost savings or avoidance as factors in the decision-making process, but financial values could not be given to intangibles such as long-term noncompliance avoidance and environmental protection. As discussed in Chapter 4, the environmental values held by management tipped the scales in several cases when cost analyses were inconclusive.

Most cases lacked a way to assign financial values and amortization criteria to environmental benefits and future compliance requirements. This deficiency forced managers to make subjective decisions if they were to proceed with clearly smart actions.

POLICY SUGGESTION *Providing installation managers a clean path of options and sensible criteria would help them reject unfit projects and select wise actions.*

3.1.3 LIFE CYCLE COSTS

One common complaint from installation personnel was the requirement to use a budget-year capitol cost basis, rather than having the flexibility (and the necessary criteria) to use long-term, life cycle cost. This is a long-standing issue at all levels of governments worldwide. Fort Lewis found cost issues particularly vexing when selecting and implementing actual projects and when attempting to ensure the viability of its compliance-driven pollution prevention program plan.

POLICY SUGGESTION *In this period of history, when the role, functions and method of government are under attack and review, the Army might wish to request (from DoD and the Congress) permission and cooperation to pursue pollution prevention as a pilot area for radical experimentation and change. Experimental searches for practical "value measures" and for accountability procedure designs would offer wide opportunity for partnerships with the Office of Management and Budget, the Environmental Protection Agency, industry and academia.*

3.1.4 PROCUREMENT AND ACQUISITION RESTRAINTS

Procurement and acquisition constraints, discussed more fully in Chapter 5, influence funding decisions directly and indirectly. Situations arose where there were unique opportunities to forestall compliance situations with new technology. However, these became almost too difficult to implement because of sole-source purchase and minimum-cost rules and/or year-end funding timetables.

Allegedly, purchasing officials make some de facto pollution prevention investment decisions by insisting on interpreting purchase specifications to satisfy the lowest immediate compliance levels. Such action interferes with conscious management decisions to strive for life-cycle cost effectiveness.

POLICY SUGGESTION *The Pollution Prevention Act of 1990 indicates that assertive pollution prevention is a high priority policy nationwide. If this is to be the case for the Army, then purchasing officers will need clearly articulated latitude in order to participate in the process. Purchasing officers currently seem to be too narrowly constrained by the rules under which they work.*

3.1.5 IDENTIFYING FUNDING SOURCES

In some cases, due to difficulties finding appropriate funding sources, project labels were changed to fit the source: e.g., pollution prevention projects were called HAZMIN or "waste reduction." Managers tinkered

with their own funding decision criteria in order to obtain funding. The point is not whether a project was useful or self-paying, it is that decision makers feel pressure to be devious in order to accomplish what Army policy says are approved goals. In the process, they waste personnel time. More importantly, they may be reluctant to attempt additional beneficial projects. The necessity to be "innovative" in the absence of clearer, officially sanctioned funding sources may be impeding pollution prevention by causing a perversion of the formally stated decision criteria.

Section 3.2 discusses funding sources. However, the fact that multiple possible sources generate confusion merits a brief discussion here. A variety of funding sources exist, each with its own set of acceptability criteria. In theory, a manager should be able to easily search the menu of possibilities and apply to the right place the first time. New missions and approaches must compete for acceptance in unfamiliar territory with well understood, traditional competitors. A major criterion in planning a funding strategy is to pick a source with a high probability of success.

POLICY SUGGESTION *The Army could help installation management sift funding source criteria and choose funding sources by establishing and defining the extent to which pollution prevention projects can receive credit for the different tangible and intangible factors discussed in this section. As will be shown later, directed amortization periods and other parameters cause anomalies, which suggests that a general review should be made to determine whether adjustments might be beneficial.*

3.1.6 PERIPHERAL CRITERIA AFFECT DECISIONS

The structure and criteria of funding sources also can influence the type and number of pollution prevention actions. For example, DESCOM's Centers for Technical Excellence program, though properly seen as a motivator and potential money source, unintentionally provided a decision criterion for funding. CTX provides recognition by peers and superiors. As a result, managers seem to have opted to fund more pollution prevention actions than they might otherwise have done. This weak evidence would hardly serve as the basis of a pollution prevention program, but it exemplifies peripheral criteria that can find their way into decision equations.

3.1.7 INFLUENCING FACTORS

None of the funding or funding timing decisions in the seven case studies appear to depend on technology catching up with need. Technology availability will surely control more funding decisions in the future, but these cases shed no light on that. They do support generally accepted views that existing technologies still can accomplish.

DoD's goal of a 50 percent hazardous waste reduction was not stated as an explicitly applied criterion for granting local funding or seeking external funding in these seven case studies.

3.2 FUNDING SOURCES

There are (or were) a number of nominally valid funding sources for pollution prevention projects. Which source is selected depends upon the exact nature and justification for a given project. Funding sources include the usual operation and maintenance, military construction, and related appropriations and accounts, but there are additional sources, as the list below shows.

Acronym	*Source*
PIF	Productivity Investment Funding
QRIP	Quick Return on Investment Program
PECIP*	Productivity Enhancement Capital Investment Program
ECIP	Energy Conservation Investment Program
MANTECH	Army Manufacturing Technology Program
WMCA	Waste Minimization Capitalization Account *This consists of tightly restricted ("fenced") funds of various types (for general waste reduction, hazardous waste minimization pilot trials, National Guard Bureau environmental projects, recycling proceeds and contractor voluntary inputs).*

*Note: QRIP and PECIP no longer exist.

These sources vary greatly as to their funding limits, timetables, availability (amount and competition), payback criteria and prejudice against projects that contain some "soft" pollution prevention benefits. The funds are variously managed at the Office of the Secretary of Defense, HQ Department of the Army, Major Commands, Major Subcommands, Army Reserves, National Guard Bureau, Army Environmental Center (AEC, formerly the US Army Toxic and Hazardous Materials Agency) and locally at installations or tenants on installations.

3.2.1 NO SEPARATE FUNDING SOURCE

Analysis of the case studies revealed that no separate pollution prevention financial source exists, though the Management Decision Package, VEPP, (fully effective in FY95 or FY96) now exists for reporting pollution prevention expenditures. Each project proponent must evaluate the possible sources and work the action through appropriate channels in hope of

succeeding. If unsuccessful in pursuing one source, they must decide to cease or to try another avenue. Pollution prevention, with its frequently large component of "soft" future cost avoidances and possible intangible benefits, does not fare well against more traditionally provable needs and proposals.

At times, more than one source seems equally appropriate, yet pursuing several funding options simultaneously is negatively viewed as an attempt to obtain multiple funding. Consequently, the failure to obtain funding from one source carries the potential for a series of protracted searches. While the search for a funding source continues, the improvement opportunity lies dormant and unfulfilled.

Despite the very logical connections between reduced energy consumption and pollutant emission reduction, none of the cases studied used Energy Conservation Investment Program (ECIP) funds for pollution prevention. Perhaps this absence is merely an artifact of the sample. If not, the Army may be missing a good opportunity to cross-tie the concepts and to provide synergistic progress in both areas. No case study respondents mentioned the Army Manufacturing Technology (MANTECH) program as a potential or attempted source, despite its existence since 1988.

3.2.2 WASTE MINIMIZATION CAPITALIZATION ACCOUNT

The Waste Minimization Capitalization Account (WMCA) would seem to provide the single most reliable source available to decision makers when building project programs. WMCA funds are available to industrial installations with three production levels: one level for peacetime, one for the surge that occurs in the transition to high production, and a level for production during mobilization. Actions taken within the WMCA framework often inherently prevent pollution. For example, not generating waste avoids direct and indirect issuance of pollutants somewhere in the life cycles of products and processes.

A weakness with WMCA is its direct correlation to assigned production quotas. Less money is available during times of low production, which is an ideal time to renovate an outmoded process system. More money is available when production is high and pollutant generation is at its highest — precisely the time when changing the process to ameliorate pollution would create the most disruption. This timing mismatch is undoubtedly an old issue for agencies long concerned with maintaining the Army's industrial facilities.

Review WMCA funding criteria (timing and amounts). Examples where the Army missed opportunities for preventing pollution and noncompliance situations support the need for this.

3.2.3 DEFENSE REUTILIZATION AND MARKETING OFFICES

The proceeds from recycling that are returned to installations for use in morale support, environmental and energy programs are another (usually modest) source of pollution prevention funding. AR 200-1 requires that recyclable materials be sold through DRMOs. One of the case studies revealed situations in which the installation could have secured more advantageous selling prices than could the servicing DRMO.

POLICY SUGGESTION *If there is rigidity of policy in this area resulting in revenue loss, relaxing the policy in specific instances might enhance local pollution prevention efforts in limited, but significant, cases. This appears to be a small area, but still one worthy of evaluation for action.*

3.2.4 FUNDING IN THE CASE STUDIES

The following summaries (in ascending order of complexity) illustrate the funding difficulties surmounted in some of the case studies.

Anniston Army Depot had CTX program support and obtained AEC funding for its role in petroleum degreasing and industrial wastewater treatment plant operation.

Fitzsimmons Army Medical Center used three sources (Optical Fabrication Laboratory internal budgets supplemented by AEC exploratory funds, augmented by funding from the Army Environmental Hygiene Agency mission) to accomplish the necessary studies and to greatly reduce their discharge of heavy metals and caustic chemicals.

Corpus Christi Army Depot did its first project with CTX program support despite the presence of a large, near-term compliance element, which implies they should have received must-fund monies. No internal funds were available. They leveraged the CTX role and HQ Department of the Army research dollars. The experience was positive, but did not carry over outside the CTX specialty.

At Milan Army Ammunition Plant, the technical problem was not immediately critical to operation, in a compliance sense, so solutions could not be tackled with "must fund" environmental money. The cost was greater than the installation could locally fund at the time. Eventually, AEC funded the project purely as a waste reduction pilot effort without considering cost savings/payback, though the project might have demonstrated strength on that criterion.

Mississippi Army National Guard experienced a striking example of the losses that can occur during the process of finding the right funding mechanism. The entire action took about five years. Two of the five years are "typical": one year to find and evaluate technologies, develop designs, and complete project paperwork, and a second year for contracting,

materials receipt, installation and placement in service. MSARNG's remaining three years are the heart of this discussion.

Application to QRIP failed because the $165,000 payback exceeded QRIP's $100,000 cap. PECIP accepted the project as fitting its criteria, but MSARNG received no money from that source. (NOTE: Both QRIP and PECIP have since ceased to exist.) MSARNG did not attempt to obtain PIF. (PIF has a relatively long time horizon for processing, and much larger projects are likely to win the competition.) The particular Guard unit local budget could not carry the item. The National Guard Bureau eventually provided the almost $300,000 then needed, from their environmental funds — cost increases during the period of delays had raised the price by 80 percent. The project did pay for itself in one year. In the end, the time-related unrealized savings amounted to about one million dollars (3 x $300,000 + $165,000 x 80/100). The inability of even QRIP (seemingly the most appropriate source, aside from its $100,000 limit) to be able to fund the project cost the National Guard six times the original project price because of the time spent finding financing.

While not reported as a factor in the MSARNG case, a policy that requires units to remit savings accrued (as QRIP and PECIP both did) is a feature that discourages local commanders from engaging in projects. Pollution prevention savings do not necessarily occur in real dollars, but in dollars that would have been requested in the future to conduct wasteful processes.

POLICY SUGGESTION *The foregoing processes for programs such as pollution prevention — where intangibles and the probability/potential for future payback play a large part — would be fruitful areas for policy adjustment. Opportunity seems to exist to enhance motivation and concrete action by removing obstacles, even without preferentially increasing money availability.*

The willingness and ability of contractors to fund pollution prevention actions were the keys to the Lima Army Tank Plant project. This willingness only occurred, however, after a basic meeting of minds had developed between the two parties. The economics were clear: the contractor would save money. The intangibles were clear: the government would get public compliance points for reducing Toxic Release Inventory (TRI) emissions.

POLICY SUGGESTION *The LATP case highlights a procurement point: cost-plus-fixed-fee contractors have no economic stimulus to seek, develop or implement pollution prevention projects at government-owned plants. Such incentives would exist if contracts included incentives such as bonuses and saving sharing. This suggestion is supported by the fact that similar elements of legitimate contractor disinterest arose in some of the other cases.*

3.3 BUDGET UNCERTAINTIES

Comments scattered through the preceding sections of this discussion on funding gave a flavor of the difficulties installations face when trying to wedge a new and still maturing concept like pollution prevention into the competition for financial resources against programs that are better understood. The cases brought forth a few specific areas of inconsistency, uncertainty and conflict which, if addressed, could aid the Army in developing and accomplishing its pollution prevention program.

While pollution prevention is itself gradually becoming a compliance field, activity is still largely voluntary and is seen as smart but not necessary. Therefore, many projects receive funds rather late in the fiscal year. From the data, pollution prevention solutions apparently depend on sole-source procurement of specialty items and materials in higher proportion than most other projects. Some study respondents argued that uncertain and late funding do not allow adequate time to properly process purchasing actions for sole-source items without severe risk of losing the funds at year end. Two of the cases mentioned the possibility of obligating funds through Corps of Engineers District Offices as ways of avoiding expiration of the funds. That worked well as an expedient method, but is an unrealistic way to conduct major, routine business in an Armywide program.

If this matter of avoiding fund expiration is a general problem for installation pollution prevention programs, it argues for a stable budgeting mechanism that will satisfy basic program needs earlier in the fiscal year.

Even when programmed as an environmental expense, pollution prevention fails to meet the criterion of "must fund." As mentioned earlier, this aspect seems to be changing and may bear special evaluation in the near future. Executive Order 12856 (August 1993), which addresses pollution prevention requirements, is likely to generate a major surge of state pressure, thus making pollution prevention a true compliance issue.

Dependence on such mechanisms as CTX and HQDA waste minimization research funds has worked well for single-need and narrowly-focused needs at single locations. Those mechanisms, however, are not easily transferred and replicated elsewhere. As previously discussed, the Waste Minimization Capitalization Account provides support that is critical for accomplishing many pollution prevention activities. Unfortunately, all three of these funding sources (CTX, HQDA and WMCA) contain built-in aspects that inhibit their usefulness for propagating broader pollution prevention programs.

3.4 SUMMARY AND SUGGESTIONS FOR POLICY DEVELOPMENT

The case study data suggests 10 potential areas for policy modifications that could improve the effectiveness of pollution prevention program funding and of the projects implemented. These are offered below as options that could be taken singly or in combination:

- Increase the funding priority for pollution prevention projects. Also be aware that in some states intensive regulatory action requires "must fund" priority. This trend may expand.
- Establish clear amortization and funding criteria that are appropriate to pollution prevention with its peculiar mix of tangible and intangible facets.
- Recreate mechanisms such as QRIP and PECIP, after modifications. Since many pollution prevention savings are *avoided* from future budgets rather than *recovered* from current ones, it is not appropriate or conducive to local initiative to require "savings" to be remitted to the treasury from current funds.
- Obtaining the tools and flexibility to shift to life-cycle environmental costing. Open areas of partnering experimentation in concert with other federal agencies.
- Enhance anticipatory pollution prevention by according purchasing officials leeway to support higher than minimally acceptable pollution correction and avoidance materials and equipment, at the reasoned suggestion of technically qualified Army personnel.
- Promulgate clear definitions and guidance for crediting (or charging) proposed pollution prevention projects with various benefits (or costs) under the existing suite of funding sources to add certainty and speed to installation programs.
- Change contracts to encourage government contractors to undertake pollution prevention initiatives for their activities on government-owned facilities.
- Stabilize the level of WMCA financing to permit anticipatory pollution prevention actions to be implemented during times of low production.
- Evaluate how the lack of formal funding for pollution prevention prevents installations from conducting rational pollution prevention programs; follow-up with appropriate measures.
- Find ways for energy conservation and pollution prevention programs to explicitly support each other.

Two final observations arise from the data. The first relates to the factors that affected funding. Neither funding levels nor timing were

limited by the availability of appropriate technology in any of the seven cases. Nor did DoD's 50 percent hazardous waste reduction goal obviously stimulate funding. While a sample of seven is not a defensible statistical basis, one might conjecture that success depended on current technology and that the waste reduction goal was irrelevant, all other factors considered.

Secondly, the cases provide no instruction at all for pollution prevention projects that failed to achieve funding.

4 MOTIVATIONAL FACTORS

Pollution prevention programs are fast supplanting HAZMIN programs at Army installations because pollution prevention programs focus more on reducing the residuals throughout the production cycle, not just at the disposal stage. Various factors motivate the switch to pollution prevention programs, as this study showed.

The concept of pollution prevention is simple, but it can be complex to apply. Although pollution prevention's benefits are compelling, regulatory and technological barriers can discourage implementation. The term "pollution prevention" tends to be interpreted differently depending on mission, waste streams and institutional approaches. Regardless of the term's interpretation, pollution prevention programs fundamentally change the raw materials, products, production processes and disposal practices that installations use.

The strongest motivation for pollution prevention projects in the cases studied was compliance with environmental regulations, but there were other factors. Command support, though often prompted by compliance pressures, can motivate entire installations to contribute to waste minimization efforts. Competitiveness and economic benefits also influence project decisions. This chapter examines six motivational factors identified in the cases: regulatory compliance, economic benefits, command support, environmental audits/future liability, access to funding, and environmental and public interest groups.

4.1 REGULATORY COMPLIANCE

Notices of Violation were a major factor for initiating pollution prevention in three of the cases studied. Three additional cases cited future compliance issues; only one case noted reasons other than compliance for initiating pollution prevention projects. Noncompliance with the existing permits and regulations thus appears to be a major factor driving the Army's pollution prevention program.

Federal, state, or Army regulations and directives dictate compliance requirements. Anniston Army Depot faced noncompliance with its National Pollutant Discharge Elimination System (NPDES) permit after

exceeding the capacity of its industrial wastewater treatment plant. Although Corpus Christi Army Depot was a tenant activity and operated under the regulatory auspices of a Naval Air Station, the depot was held directly responsible for violations of a Clean Air Act permit issued by the Texas Air Control Board.

At least fifteen states have taken the lead in pollution prevention programs and have included mandatory facility pollution prevention planning (AEPI, June 1992). Mandatory facility planning programs, such as the one adopted by the state of Washington, require comprehensive plans that identify opportunities to eliminate or reduce pollutants and incorporate pollution prevention in ongoing plant processes. Fort Lewis, located in Washington state, consolidated its various pollution prevention related projects to establish a consolidated pollution prevention plan to comply with state law.

Previously accepted disposal practices can be major sources of contamination and hence cause compliance problems. In the case of FAMC's Optical Fabrication Laboratory, pollution prevention activities eliminated the use of hazardous materials which could have caused compliance problems in sludge and wastewater effluent, although the previous disposal practices had not resulted in NOVs.

4.2 ECONOMIC BENEFITS OF POLLUTION PREVENTION

Economic competitiveness was the main focus for the pollution prevention program at Milan Army Ammunition Plant, operated by Martin Marietta. After reducing the pinkwater production through in-process recycling and converting from a wet to a dry vacuum system, MAAP saved over 50 percent of the operating costs for two production lines. By participating in pollution prevention projects, the contractor reduced material, labor and disposal costs, thus operating more cost-effectively.

The Lima Army Tank Plant, operated by General Dynamics Land Systems Division, is another good example of pollution prevention changes that were motivated by cost savings. Using off-the-shelf technology, LATP reduced its use of 1,1,1 trichloroethane in the weld quality inspection process by more than 82 percent, with a payback period of six months. In addition to economic gains, LATP replaced a material that soon will be unavailable for industrial application.

Reducing or eliminating wastes produces financial benefits in the following ways:

- Reducing raw materials use, compliance costs and future liability for the pollution
- Increasing non-economical benefits of minimizing uncertainty

- Avoiding cross-media transfers (air-water, water-soil, etc.)
- Protecting resources

Both of the civilian contractors in this study realized economic cost savings from their pollution prevention efforts.

4.3 COMMAND SUPPORT

Commanders hold the ultimate stamp of approval for activities on an installation. Therefore, they and their staff are the program drivers, in most respects.

4.3.1 EXAMPLE: ANNISTON ARMY DEPOT

Anniston Army Depot's assertive attention to pollution prevention is directly linked to the commander's personal commitment to environmental compliance. Motivated by several NOVs, management indoctrinated the workforce and specifically assigned responsibility for pollution prevention. (Supervisors' performance appraisals now reflect their success with waste reduction measures.) The workers' knowledge of production processes and actions that they can take to reduce pollution within their work areas, both collectively and as individuals, has significantly impacted the overall waste stream reduction. This approach has embued the workforce with a sense of ownership of the pollution prevention program, and appears to be the primary supporting factor in ANAD's success. In this case, active personal involvement by the commander stimulated employee participation.

Commanders also can encourage pollution prevention involvement by initiating annual awards programs. ANAD rewards both the employees and their supervisors for suggestions that reduce pollution. Commanders can encourage participation in installation-wide pollution prevention efforts in many creative ways.

4.3.2 EXAMPLE: MISSISSIPPI ARMY NATIONAL GUARD

Top management leadership also largely motivated the Mississippi Army National Guard's pollution prevention achievements — aided by a cooperative workforce, good lines of communication, and use of off-the-shelf technology. The Commander of the Aviation Classification and Repair Activity Depot delegated responsibility for pollution prevention and empowered employees to make pollution prevention decisions. This significantly added to the success of the program. A number of pollution prevention initiatives reduced the overall hazardous waste generation rate at the depot by approximately 90 percent.

4.4 ENVIRONMENTAL AUDITS/FUTURE LIABILITY

The pollution prevention program at FAMC's Optical Fabrication Laboratory (OFL) began as a result of a cooperative environmental audit program. The pollution prevention assessments took place under the Waste Reduction Evaluations at Federal Sites (WREAFS) program coordinated by EPA's Risk Reduction Engineering Laboratory. Follow-up on the WREAFS study led OFL to eliminate discharges of corrosive wastewater contaminated with lead and cadmium.

Army installations are subject to periodical environmental audits sponsored by EPA, state regulators, higher commands or internal inspectors. These inspectors often conduct planned or unplanned audits to uncover potential environmental compliance problems. Recommendations or NOVs resulting from the environmental audits can stimulate pollution prevention activities, as discussed previously. However, an installation that passes inspections with no significant findings during an environmental audit may develop a complacent attitude and a false sense of security.

Environmental audits also examine the issue of future liability. Past waste disposal activities have resulted in the current enormous environmental cleanup endeavor. Army environmental programs emphasize the reduction of future liability by preventing pollution today.

4.5 ACCESS TO FUNDING

As a participant in the DESCOM CTX program, Corpus Christi Army Depot was designated as the CTX for reducing wastes generated from aluminum conversion coating. The mandatory fencing of funds through WMCA supported this program's success. Depot personnel solicited other funding sources such as QRIP and PECIP to initiate pollution prevention projects.

Army- or MACOM-level sponsored programs to achieve waste minimization objectives provide a means for installations to initiate pollution prevention programs. See Chapter 3 for more discussion of how the access to funding affects pollution prevention programs.

4.6 ENVIRONMENTAL AND PUBLIC INTEREST GROUPS

Some environmental groups that have adversarial relationships with installations over a number of issues might be expected to demand pollution prevention efforts. But in this study, outside organizations showed little or no interest in pollution prevention. For example, at

Anniston Army Depot the National Resources Defense Council expressed only mild interest over ANAD's Clean Water Act compliance.

Passage of the federal Emergency Planning and Community Right-to-Know Act (EPCRA) provides community access to toxic release data. The recent Executive Order 12856 requires Army installations to comply with EPCRA in filing toxic release information. When they do that, the data will highlight the necessity for pollution prevention. The public generally looks favorably upon pollution prevention actions as demonstrations of proactive commitment.

4.7 SUMMARY AND SUGGESTIONS FOR POLICY DEVELOPMENT

The important motivational factors in the pollution prevention case studies suggest the following policy elements for consideration:

- Issue policy guidance giving highest priority to a pollution prevention approach for meeting compliance requirements.
- Define and issue acceptable criteria for cost savings in relation to the other benefits of pollution prevention. It was apparent from the case studies that no pollution prevention changes would take place in manufacturing facilities unless the production process itself was threatened to be halted or the proposed changes could save the operating contractor manufacturing expense.
- Develop a policy providing options for rewarding entire work teams for innovative pollution prevention activities in their work area. Incentive programs now in place tend to focus on individuals.
- Develop a rational basis for assessing the impact of future liability and use that basis for implementing the pollution prevention program. Past waste disposal activities have resulted in the current enormous environmental cleanup endeavors. Pollution prevention reduces future liability concerns.

5 PROCUREMENT FACTORS

This chapter examines how regulatory and other influences on procurement affected pollution prevention initiatives at the installations studied by looking at how procurement overlaps with issues of compliance, funding and military specifications.

Regulations that specify material use, spending procedures, maintenance procedures, competitive bidding procedures and recycling processes — among others — restrict the ability of Army environmental and industrial managers to reduce pollution by incorporating pollution prevention initiatives into their facilities. In 1990 the 101st Congress created the Acquisition Law Advisory Panel (ALAP) to examine procurement "streamlining" and laws pertinent to federal and DoD procurement. There is a growing realization that over-regulation in procurement is stifling technological development (ALAP, 1993). The bibliography includes full citations for recent works on the subject by Carter (1990) and the Defense Conversion Commission (1992).

The cases in this study support the notion that too much regulation of the acquisition process reduces an installation's ability to adjust its systems to prevent pollution. This information may complement procurement reform efforts by adding to existing knowledge on procurement obstacles, or it may reinforce existing information on these issues. Six problem areas are examined separately.

This study identified the following specific procurement issues:

- Acquisition regulations discourage long-term purchasing decisions (purchasing officers base purchases on barest levels of compliance).
- Deadlines for funding obligation are often unrealistic or conflicting.
- Depot Maintenance Work Requirements (DMWRs) specify the use of virgin materials.
- It is difficult to get approval to substitute appropriate products.
- Local procurement efforts may be redundant and uncontrolled.
- Justification procedures for sole-source purchases are cumbersome.

This study (unintentionally) focused on pollution prevention successes, so none of the procurement-related problems were fatal in the cases examined for this report. However, in almost every case, a lack of dedicated manpower inhibited efforts to procure special equipment. Respondents were also frustrated at not being able to use high quality recycled products because of Depot Maintenance Work Requirements that mandate the use of virgin materials. These issues were only inhibitors in these focus cases, but may be fatal in many cases that go undiscovered.

5.1 ACQUISITION REGULATIONS

A string of regulations direct materiel acquisition within the Army. These include the Federal Acquisition Regulations (FARs), the Defense Federal Acquisition Regulations Supplement (DEFARS), the Army Federal Acquisition Regulations Supplement (AFARS), and the Engineering Federal Acquisition Regulations Supplement (EFARS). Additional Department of Defense directives, instructions and other Army regulations on acquisition and pollution prevention (including DoD Directives 4210.15 and 5000.1, Instructions 5000.2 and 6050.9, and ARs 70-1, 200-1 and 200-2) complement this complex set of regulations. AMC will update and add additional works soon.

5.1.1 BAREST COMPLIANCE

One significant obstacle that has been observed before and was validated by this study is that contracting personnel reduce the stringency of pollution prevention material and equipment requests that would result in pollutant reductions beyond bare compliance. Many times, their actions position the Army at bare compliance levels without additional room for error or stewardship. Contracting officers are able to reduce stringency because requests for equipment purchases include a list of the equipment's "salient characteristics" which forms the basis for a competitive purchase. If a salient characteristic exceeds minimum compliance requirements, the contracting officer has the authority to replace it with the minimum requirement essential to meet the prevailing needs of the government. The requesting party can provide written justification explaining the benefits of each salient characteristic with the list, but the final decision, based on acquisition regulations, is made by the contracting officer.

For example, if an installation wanted to buy a device that reduces air emissions of a certain waste from a process to 1 gram per cubic meter but the current environmental regulations allow emissions to contain 10 grams per cubic meter, the procurement office would write a specification for a 10-gram device unless they were convinced the 1-gram device served an additional useful purpose. Anniston Army Depot and Fort

Lewis both indicated that they experienced difficulties with contract officers using compliance requirements as cut-off points for pollution reduction efforts.

For contract officers to promote bare compliance is not necessarily a bad thing. Financial constraints dictate that some limit must be set, and compliance seems a logical place to set it. Unfortunately, environmental compliance is a misleading limit; a forward-looking environmental manager or engineer who correctly predicts increased restrictions can save future expense (and organizational panic) by moving toward a discharge reduction before the compliance rules change. If the contracting officer impedes this improvement, efficiency is lost; future money will be wasted when some change is later mandated: the change will have become more expensive, and there will be less time to make an adjustment. Pollution prevention acquisition needs are different from other acquisition needs because pollution prevention aims to obviate future compliance problems by reducing the hazardous waste or removing it completely — even if that involves an additional, not strictly necessary, expense at the present time.

Compliance suggests conformance to a set of rules; in environmental compliance the rules frequently change to become increasingly restrictive. To keep up with their rate of change, it is often necessary to go beyond specific demands. A restrictive interpretation of "compliance" nullifies technical managers' attempts to reduce pollution through process changes, and defers pollution prevention decisions to contract officers.

POLICY SUGGESTION

A separate designation for waste- and pollutant-reducing acquisitions could be developed to simplify and encourage purchasing material and equipment designed to minimize waste and pollutant generation. Environmental decisions thus could be placed back in the hands of the technical managers.

Lima Army Tank Plant's project was not impeded by procurement restrictions. They made a preventative change and greatly reduced chlorinated hydrocarbon emissions years before being required to do so, thus saving a substantial amount of money, future effort and potential production disruption. On the other hand, Milan Army Ammunition Plant recently reduced their water-borne explosive waste discharges well below compliance compared to levels stipulated in their NPDES permit, yet they still are likely to experience problems with their next permit application because EPA has since set even lower levels. This second example illustrates the need for flexibility in reducing waste below a temporary compliance level.

5.1.2 REGULATIONS DISCOURAGE LONG PAYBACKS

A second issue installations identified is that regulations favor minimizing initial capital investment costs at the expense of life-cycle costs of projects that are designed to reduce waste and to spread compliance costs over longer payback periods. Life-cycle costs are mentioned in numerous DoD documents (including Directives 4210.15 and 4140.60, Instruction 5000.2 and AR 70-1) and are defined for hazardous materials as "the period starting when the use or potential use of hazardous material is first encountered and extending as long as the actual material or its after effects, such as a discarded residual in a landfill, have a bearing on cost..." (DoD Directive 4210.15).

Although Department of Defense policy states that "... hazardous material shall be selected, used, and managed over its life cycle so that the Department of Defense incurs the lowest cost required to protect human health and the environment" (DoD Directive 4210.15 § D), Fort Lewis noticed that this was not occurring in practice. The Army Acquisition Pollution Prevention Support Office has addressed this issue (AAPPSO, 1992). Section 7.3.3 of that document is especially pertinent:

> The contractor's Pollution Prevention Program tasks shall address the entire life cycle to ensure optimization between the performance, operational, and logistic support requirements (including disposal and demilitarization requirements), the constraints on hazardous and environmentally unacceptable materials and the costs associated with the use, handling, treating and/or disposing of these materials and bi-products.

POLICY SUGGESTION *Re-examining acquisition regulations as they relate to Army pollution prevention would help identify additional conflicts and inconsistencies between policy and practice. Energetic Army participation in federal and DoD acquisition reform efforts is key to that re-examination.*

5.2 FUNDING AND OBLIGATION DEADLINE EXPIRATION

Funds arriving late in the third quarter that must be spent by the end of the fiscal year create long-term financing problems for pollution prevention purchases. Anniston Army Depot, Corpus Christi Army Depot and Milan Army Ammunition Plant all reported procurement setbacks because they waited to discover their budget allocation before committing to pollution prevention purchases. Both ANAD and CCAD dealt with this situation by obligating funds for purchases through district offices of the Corps of Engineers (who presumably had line-item authority for equipment purchases). ANAD also volunteered as a test bed for AEC projects through

the DESCOM CTX program, which reduced manpower requirements and funding problems. These are temporary solutions, limited in applicability, and not reasonable options for every installation.

Long-term purchasing decisions are difficult because the amount of funding is not known until the money actually arrives; once it does, pollution prevention purchases compete with regular purchases for the attention of the procurement office. The "use it or lose it" approach may work well for accounting purposes, but it is inadequate for pollution prevention planning. The de facto deferral of pollution prevention projects to a year-end decision status, subject to the availability of funds, implies that the projects are considered desirable but not necessary.

POLICY SUGGESTION *If facilitating pollution prevention is a DoD and Army priority, then purchases for waste and pollutant minimizing equipment and materials need to rate higher and be given more attention in spending decisions at those levels.*

5.3 VIRGIN MATERIAL REQUIREMENTS

Depot Maintenance Work Requirements specify maintenance procedures and mandate the use of virgin materials in some cases where recycled material substitutes of adequate quality are readily available. When recycled materials cannot be productively reused, they are held or sent to DRMOs where they are likely to be disposed of as waste. Anniston Army Depot recycles Halon from combat vehicle fire extinguisher systems, but DMWRs keep ANAD from reutilizing this material. Instead, ANAD stores it in barrels and must purchase new Halon to refill the extinguishers. It is likely that other installations also handle materials that could be productively reused but are discarded because of outdated military specification requirements.

POLICY SUGGESTION *With the current quality of information technology, the increase in the number of alternative materials and processes available, and the advent of the ability to reclaim materials to high specifications, depots could substitute high-quality recycled materials based on internal decision making. Such substitutions could save money on virgin material purchases and on the disposal of spent materials.*

Virgin material specifications should be further investigated to determine which restrictions remain necessary, given today's technology. This suggestion agrees with the draft HQDA Pollution Prevention Policy which states: "In all Army procurement, the use of recycled materials (i.e. materials derived from post-consumer or agricultural waste, industrial scrap, or other recyclable items) will be favored in

accordance with Executive Order 12780" (HQDA LTR 200-94-1, Section 5.d(5)). Full implementation of this policy could cut through inhibiting DMWRs.

5.4 APPROVAL PROCESS FOR PRODUCT CHANGES

The policy of requiring approval of proposed process changes before they are implemented ensures that important but subtle effects on a process are not overlooked. However, the current process is quite lengthy and creates needless delays. Also, there is no mechanism for sharing the reasoning behind specifications. DoD Directive 5000.1, Instruction 5000.2 and AR 70-1 mandate the current approval procedures.

For several years ANAD's Cleaning and Plating Branch has been trying to get approval from the Tank Command (TACOM) to change the anti-corrosive plating on fasteners. Similarly, Corpus Christi Army Depot was required to obtain approval from Aviation Technical Command for each of their coating substitutions. Personnel at these two installations were frustrated at the need for separate approval for every single nut, bolt, and clamp; the coating change at ANAD involves a list of several hundred parts, and every piece requires separate justification and approval. The approval process is quite lengthy and creates needless delays in converting to a more environmentally benign technology.

POLICY SUGGESTION *Increase the information that is available to plant engineers (via a specifications database or electronic bulletin board, for example) to provide the technical staff with a quick reference for the reasoning behind certain specifications and thereby expedite the approval process.*

In ANAD's case, TACOM's concern was that aluminum-coated fasteners may not provide adequate torque resistance. If ANAD personnel had known this was a likely concern, they could have provided their own test results early in the approval process. Having plant engineers review the rationale for specifications also might lead to the identification of new pollution prevention opportunities.

5.5 LOOSE TRACKING AND UNCONTROLLED LOCAL PROCUREMENT

Fort Lewis personnel uncovered a need to restrict acquisitions made by their Directorate of Contracting for various installation organizations because of problems with over-procurement, limited shelf life, and purchases of materials that did not meet specifications. Purchases containing hazardous material were being made with credit cards and from contractors as well as through DOC. Both DOC and the Directorate of

Logistics (DOL) used their own purchasing numbering system and purged their computer records at the end of each year, so any attempt to track purchases had to be done by hand-sorting files. Environmental staff viewed this as a serious waste problem and brought it up for discussion with AMC, FORSCOM and at environmental conferences they attended; until recently, the response was less than encouraging.

In a recent development at Fort Lewis, the inspector general and pollution prevention manager organized a Hazardous Material Management Process Action Team to investigate consolidating and standardizing the purchasing process to facilitate tracking hazardous materials. Both DOC and DOL are represented, as are DRMO, Preventive Medicine and other groups involved in the process. They plan to start by tracking paint and antifreeze. Eventually, they hope to implement a computerized tracking system that will trace all material purchases from procurement to ultimate disposal. This system would allow them to check their inventory for a material before unnecessarily purchasing more, and reduce the likelihood of unused material expiring on the shelf. This approach could provide a valuable model for other installations to follow.

5.6 SOLE-SOURCE PURCHASE JUSTIFICATION

In some cases, only one manufacturer produces pollution prevention equipment that an installation can take off-the-shelf and install in a specific waste-minimizing process. In these cases, a sole-source justification must be submitted with the purchase order. Justifying a noncompetitive purchase requires cumbersome paperwork and considerable time for document preparation and approval (AFAR 6.3-5, 1988); the approval process alone can take six months. A potential route around this justification process is to submit a detailed list of salient characteristics rather than to specify a particular manufacturer. However, this approach is also time consuming, and approval by the contracting officer still can be problematic, especially if the request exceeds minimum compliance requirements (as discussed in Section 5.2.1).

Corpus Christi Army Depot faced this problem while experiencing difficulties in a separate pollution prevention effort they mentioned as an aside to the study. CCAD has a small environmental staff; procuring equipment produced by only one manufacturer was especially problematic because environmental personnel had to dedicate long hours to sole-source justification forms.

POLICY SUGGESTION *Appropriate agencies need to review sole source controls. The goal should be to maintain competition, while giving weight to factors such as timeliness and uniqueness that are specifically involved in pollution prevention actions.*

5.7 SUMMARY AND SUGGESTIONS FOR POLICY DEVELOPMENT

The case study data suggest potential modifications to improve effective procurement for pollution prevention programs and projects. These are offered below as options that could be taken individually or in combination:

- Give environmental program officers the authority to specify pollution prevention equipment.
- Strengthen and enforce the policy supporting a life-cycle cost basis.
- Examine Army acquisition regulations to discover conflicts, inconsistencies and inhibitors to pollution prevention implementation. Participate in the interdepartmental effort to reform federal acquisition regulations.
- Make pollution prevention projects a budget line item to increase their funding authority.
- After explicitly reviewing needs, issue policy statements to encourage the use of high-quality recycled materials that meet essential standards in place of requirements to use new materials.
- Shorten the approval time for product substitutions. Consider options to provide installations with the knowledge and authority to make reasonable material substitutions without unnecessarily lengthy approval processes for each proposal.
- Develop and implement uniform systems for cradle-to-grave tracking of all potentially harmful but unregulated installation procurements to reduce redundant purchasing, product on-shelf expiration and disposal costs.
- Ease the justification process for sole-source purchases of environmental waste and pollutant reduction equipment to expedite purchase orders.

A simplified procurement process for the Army could facilitate the transition from less efficient manufacturing and maintenance procedures to the more efficient and environmentally benign procedures demanded today and expected in the future. This adjustment could help the Army in its effort to assert leadership in environmental stewardship.

6 ADDITIONAL POSITIVE AND NEGATIVE FACTORS

The following case study issues deserve additional mention or do not fit into the other major categories. These subjects arose with less frequency than the major category items, but deserve attention because they seriously influenced the outcomes of their respective, specific pollution prevention cases. One would expect the same or similar factors to be at work elsewhere in the Army, aiding or impeding pollution prevention efforts. Therefore, their inclusion here is appropriate. Disregarding them could deprive the Army of meaningful opportunities to make beneficial policy decisions.

6.1 "TARGET" DIFFICULTIES

Setting gross waste reduction targets confused and demoralized personnel at the one production installation where this was reported as an issue. Progress toward targets set under a regime of low or modest production could not be sustained when orders and production surged. To minimize this negative effect, the policy should be to set targets based on units of pollutant per unit of production. This might make reporting more complicated (it could be hard to settle upon conversion factors needed for aggregating the numbers needed for management and public reporting), but the change should increase local effectiveness.

Yet another difficulty arises when changes in the rules redefine "wastes." Generation rates typically rise dramatically without any actual increase having occurred. Motivating the workforce to reduce waste and pollution requires maintaining a credible atmosphere of fairness, which could be facilitated by rapid, logical adjustment, based on local advice.

POLICY SUGGESTION

Those who set waste reduction targets need additional flexibility to adjust for differences in superficially similar but actually unequal units of production (e.g., one tank could require a waste-intensive repair while another, requiring a different type of repair, might generate very little waste). When practical necessities such as reporting to headquarters and MACOM dictate a reliance on blanket goals, making special efforts to solicit local input would enhance cooperation and motivation.

Incorporating recommendations from local experts when targets are set is likely to have the following two major results:

1) Short-term difficulty in consolidating and explaining MACOM and Armywide accomplishments and failures
2) Long-term maximization of real waste reduction

6.2 FUNDING CRITERION MISMATCH

The Waste Minimization Capitalization Account appears to be tied to production rates. As a result, during Desert Storm when one installation experienced high order and production rates, money was available for activities to cut waste generation and the attendant environmental and disposal costs. However, because the engagement was so brief, fundamental preventive projects could not be put into place before it ended. When wartime demand relaxed and it would have been physically possible to implement the improvements, the financial window had closed. This case raises the question: are there similar barriers in other projects which should be reviewed for possible relief? If such apparently accidental impediments can be located and then objectively modified when appropriate (or retained for clearly explained reasons), attentiveness to pollution prevention program policies is likely to improve.

POLICY SUGGESTION *For production facilities to be able to minimize pollution during times of high production, the Army should evaluate and adjust funding-timing criteria when low levels of pollution are being generated. This is a question of timing and readiness rather than a complaint of inadequate funds, per se.*

6.3 COMPETITION

There is much talk in the public and private sectors of harnessing competitive forces to drive pollution prevention programs. Two findings from the same location show the precariousness of making blind assumptions that have not been validated for individual sites. At one GOCO manufacturing site, pollution prevention activity received strong impetus from a generally held belief that failure to compete — in terms of environmental issues and cost — with other depots could lead to closure and catastrophic financial loss to the employees and contractor alike. In this case, competition helped drive pollution prevention. However, the contractor did not want to share the technological and organizational

details with other depots, because to do so would (as it was widely thought) lessen this installation's competitive advantage.

POLICY SUGGESTION *To maximize the benefits of pollution prevention advances developed at individual facilities, the Army will need to consider carefully the full range of behavioral responses involved, then develop policies, contract provisions, incentives/penalties and awareness activities to nullify the benefits of undue self-interest.*

6.4 AWARENESS AND ATTITUDES

Anniston Army Depot includes a wide range of elements to encourage behavioral change in its pollution prevention program. The effects go far beyond generating and implementing pollution prevention ideas. Community awareness and approbation grow directly from information releases, and indirectly from the interaction of government and contractor personnel in their off-the-job lives in the community.

POLICY SUGGESTION *To utilize political support-building opportunities such as those at ANAD, pollution prevention programs and projects should be cross-tied with public affairs programs to be mutually leveraging. A related action could be to assign economic value points for intangible benefits that accompany pollution prevention activities and allow their use to tip economic decisions.*

6.5 RISING ABOVE POTENTIAL CONFLICTS OF INTEREST

In two of the cases studied, employees resisted the proposed changes because they believed that people would lose their jobs. Management, in both cases, focused on ameliorating the most pressing compliance issues and achieving cost reductions, and initially failed to recognize the job security implications of the otherwise obvious "improvements." At the Lima Army Tank Plant, a GOCO facility, the benefits were shared: the contractor realized direct savings, the government avoided the onus and special problems that were about to begin regarding the release of toxic organic vapors, and the workers' needs were recognized by adjusting the work schedule to provide rest from the stresses imposed by the technology change. In this situation all three parties gained, though job security was the last potential impact area to be recognized.

The second case concerned a government-owned, government-operated (GOGO) production facility where the potential for a serious noncompliance situation forced a radical technology shift. Again, man

agement was focused on external dangers and forgot to anticipate and alleviate an otherwise non-issue: unemployment through automation.

POLICY SUGGESTION *If Army pollution prevention policies and programs are to be fully successful and to enhance the positive factors discussed in Chapter 4, they will have to forthrightly address the extent to which benefits will be shared with employees. They also will need to state criteria by which local commanders or managers may forego some financial returns in order to implement sensible projects that might not meet conservative investment standards.*

The Mississippi Army National Guard case exemplifies the advantages of an environmentally aware commander and a highly communicative staff. All parties recognized the problem and the need for change, and shared a willingness to work and to consider unconventional ideas. The case's story reveals the essential elements of TQM at work, but without mention of the formalities. Essential aspects of similar cooperative behaviors showed themselves at the Lima Army Tank Plant, even though a contract separated the government and contractor managers. The MSARNG case supports the view developing in industry and a wide range of the literature that pollution prevention may be an ideal candidate for TQM (President's Commission, 1993).

In yet another example, mutually supportive attitudes between regulators and Army managers (EPA with FAMC; the state of Washington and Fort Lewis) contributed to those successes in spite of the many real and potential conflicts of interest.

POLICY SUGGESTION *The Army should consider explicit efforts to marry these two programs: TQM as a supporting process and pollution prevention as the product, with the Environmental Program as a sponsor of the relationship and source of specialized support.*

6.6 ASSIGNED STAFF NEEDED

The need for specifically-assigned (often referred to as "dedicated") staff is a topic that arises repeatedly in pollution prevention literature and pollution prevention conferences. However, the experts have a spectrum of opinions on how to structure that dedicated staff. Some experts believe that focal points and sharply defined programs are necessary. Others say that pervasively integrating pollution prevention, on the TQM model, is the answer. Still other experts espouse a model that includes a focal point to stimulate awareness, support experts, and compile reports — while

promoting and facilitating pervasive integration that will produce the concrete results.

The data from this study are mixed, as well. At least three of the installations reported the lack of an assigned pollution prevention focus as a factor that seriously impeded the program's success. Having a focus person vitally aided Fort Lewis' success in forming its program and meeting state compliance requirements. The FAMC project did not depend on a pollution prevention focal person, per se, but had a person assigned full-time to the one job. At MAAP, the environmental function provided oversight and information services but did not participate in decision making. And, for the Mississippi Army National Guard, people who knew they needed the results simply did the job.

6.7 ROLE OF COMPLIANCE PRESSURES

Overall, five of the cases began as compliance response issues. The two sites which did not involve a compliance situation were Fitzsimmons Army Medical Center and the Mississippi Army National Guard. The FAMC project started after its need was accidentally discovered through an industrial hygiene survey; it became a mixed pollution prevention/ compliance action. The MSARNG projects started as a dual waste reduction and cost cutting effort, with the least concern for compliance requirements seen for the seven cases reviewed.

The concern with compliance pressures (whether actual or expected) in the five remaining cases is not surprising, given three factors: 1) the studied actions commenced largely before the Pollution Prevention Act of 1990 set a national policy, 2) pollution prevention has only recently become a popular rallying cry recognizable to citizens at large, and 3) there were no other strong stimuli for change. As they discussed the need for additional environmental/pollution prevention staff, respondents indicated that for the Army pollution prevention program to evolve into a natural, routine way of doing business, it would require a pollution prevention focal point that is not burdened with fighting crises. Still, there is no sharp evidence for one solution. Policy, in such forms as staffing standards, may have to reflect a range of options suited to the variety of installation cultures.

6.8 WASTE AND RECYCLABLES: DEFINITIONS AND DISPOSITION

Two of the installations pointed to problems caused by the definitional problem of how the Army and regulators and the Defense Reutilization and Marketing System designate substances as "waste" or "material." This is a factor that appears over many years as either a problem or an

answer to various procedural difficulties. It appears to be a problem with implementing pollution prevention programs, especially affecting installations that host Defense Reutilization and Marketing Offices. Installations attempt to minimize wastes, particularly hazardous wastes, by various means. They are bound by Army regulation to dispose of hazardous waste and recyclable material through a DRMO. The installation identifies a hazardous waste and reports it, showing amounts which then become the basis for calculating progress/regress toward reduction goals. The DRMO takes the substance, labels it a material for sale or recycling, and attempts to sell it at a profit or to pass it to a user as a financial wash.

Anecdotal evidence contends that the vigor applied to find buyers is insufficient, with the result that wastes become materials that become wastes again as they are sent to terminal disposal. At that point, the substance and quantity are recorded as a new generation. The installation, as the legally defined generating facility, thus is charged for the batch by the reporting system. This is claimed to grossly warp the measurement of progress. It was beyond the scope of this study to verify or disprove the assertions, but the claimed bad effects of the definitional mismatch do appear plausible and worthy of evaluation.

Another aspect of definitional mismatch negatively affected the DRMO host installation studied in this project. The picture of their pollution prevention and waste minimization progress can be seriously clouded by the import of materials from other DoD activities served by the tenant DRMO. If the material is turned in as a material for recycling but no recycler can be found, its definition changes to a "waste for disposal." As discussed above, the hosting installation's record assumes the stigma of generating that waste. Paradoxically, the originating activity is reinforced in its behavior by receiving positive rewards for "recycling" and they have no incentive to reduce waste/pollutant generation rates.

Both of the preceding situations, if true, work against the kind of morale needed to start and maintain dynamic pollution prevention and waste minimization programs. They institutionalize a progress deficit.

POLICY SUGGESTION *If the contentions described above are valid, the Army might join with the other services at a high level to approach DoD with proposals to reform reporting definitions to avoid double-charging and to avoid undeserved transfer of "blame" to host installations.*

Another area to explore is the extent to which freedom should be granted to installations to sell their own recyclable materials. A major criterion of "maximum profit" could be applied locally to determine whether the installation or the DRMO would handle a given commodity or batch, rather than relying on single-solution approaches.

6.9 CHOICE OF TECHNOLOGIES

Action and success depend on the convergence of stimuli, receptiveness and facilitating factors. All the cases in this study used pre-existing technologies, some available for many years or decades. The problems and opportunities yielded to simple or long-available technologies. They might have yielded even more productively to ones that are newer, unproven, or yet to be developed. This observation gives rise to another question: If it took so long for old, existing technologies to see application in these seven cases, what are the prospects for new, untried approaches to be attempted? Evidence from these cases implies that, while technology is important, non-technological factors are the critical inhibitors to improvements in pollution prevention.

POLICY SUGGESTIONS

This observation gives rise to three suggestions for policy formation.

- *Adjust total institutional processes to make pollution prevention changes easy, though rationally disciplined, and not bound by strictures invented in prior times to solve other problems.*
- *Establish criteria for balancing the search for perfect, new technologies against the use of known but immature technologies.*
- *Establish criteria for balancing the recognition that easy answers are often the best answers, against the tendency to choose easy answers because it might be too difficult to sell more effective technologies within existing institutional habits and limits.*

7 CONCLUSION

The observations and findings of this study cover too wide a range for beneficial repetition and summary here. To initiate and institute useful change, look to specific sections for issues and policy options lying within a particular area of interest or authority.

If there is one overall finding, it is that the accumulated "insults" of many small impediments operate to prevent or slow the implementation of pollution prevention principles. They result both in failure to gain environmental and economic benefits of pollution prevention, and failure to reduce the value of gains that are achieved. Most of the impeding factors, when viewed alone, may appear to be of too small merit to deserve the effort of fixing. Likewise, factors that make things work well may seem too small and specialized to deserve the attention needed to make them more widely useful. However, focusing attention on these smaller issues appears to be a wise approach for invigorating and sustaining pollution prevention programs and projects.

The case studies did not reveal any magical "silver bullets," but they did clearly show the following:

- When several individual negative factors, each of low or modest impact, concentrate their effects at one place and time, the effects can be crippling.
- Facilitating factors have synergistic and surprisingly beneficial effects when they coincidentally support and reinforce each other.

Fixing and enhancing a plethora of small institutional factors thus appears to offer a challenging but productive way to expand and energize an installation's pollution prevention programs and projects. To achieve this, the Army must choose from the following options:

a) Undertake a tedious, broad-brush effort to appropriately fix or enhance *all* factors.

b) Identify and implement a *select set of key factors* to be fixed and enhanced.

c) Allow normal evolutionary processes to generate adjustments.

Option "b" appears the most attractive, though it would not be a trivial task to identify and reach consensus on a few factors with positive multiplier effects strong enough to override the remaining inhibitors.

Many events and advances in Army pollution prevention efforts occurred while the case studies and this document were being completed. Many of these events were preparatory for implementing a formal Department of the Army Pollution Prevention Program. They include such key elements as: Army staffing and issuance of a pollution prevention policy memorandum (as a precursor to adding major new material to AR 200-1), drafting an Armywide pollution prevention strategy document, continuing the military specification review effort, and promulgating Presidential Executive Order 12856 "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements" that directs assertive federal agency pollution prevention programs.

Those activities and others, far from rendering the case study findings obsolete, set the stage for energetic application of the findings and policy options. The seven cases reviewed, though not truly randomly selected, did provide an extremely wide range of inhibiting and facilitating factors, as hoped. Though not exposing a magic solution to make all pollution prevention projects successful, the study objectively validated the reality and influences of a large number of problems that can and do retard and diminish pollution prevention projects. It also highlighted many factors, which if more widely used and strengthened, can help guarantee the success of future pollution prevention programs and projects.

APPENDIX A:
CASE SUMMARIES

ANNISTON ARMY DEPOT (ANAD)

Location: Anniston, Alabama

Size: 15,243 Acres **Command:** AMC

Primary Mission: Rehabilitate and reconstruct armored combat vehicles

Operation Wastes: Sludges, abrasive blast residues, cleaning and painting solutions, wastewater from metal cleaning and refinishing (heavy metals and cyanide)

Pollution Prevention Project: Reduce cadmium waste by changing the metal plating technique from a cadmium electroplating process to Aluminum Ion Vapor Deposition.

Previous Problems: Hazardous wastes produced at various phases of electroplating process contaminated rinse water with cadmium and cyanide and added to the volume of hazardous sludge at the Industrial Waste Treatment Plant.

New System Benefits: The new process reduces cadmium contaminated sludge by 90 percent (estimated savings of $270,000 per year in electroplating costs) by heating and vaporizing aluminum in a vacuum and electrostatically depositing aluminum vapor on the part surface with no hazardous waste production. This process also reduced the water requirement and improved the workers' environment.

Information Source: Collected through conferences and visits to military and private facilities.

Project Support:

- Funding provided by AEC-DESCOM Center for Technical Excellence Program.
- Full support from Depot Commander.
- ANAD has a high level of prevention awareness among personnel and has made significant efforts to educate the workforce on plant processes and relative waste stream contributions of each section.
- Institutional support provided by the Depot Environmental Management Division within the Directorate of Industrial Risk Management, the Environmental Support Branch within the Directorate of Maintenance and the facility-wide Environmental Quality Control Board.

Barriers to Success:

- Lack of environmental manpower dedicated to systematic pollution prevention forces. Focus on conventional compliance measures. Not enough manpower to complete paperwork to acquire pollution prevention equipment.
- Procurement specifications' concentration on bare compliance prevents forward-looking programs that attempt to stay ahead of compliance.
- Funding and obligation deadlines interfere with equipment purchasing; currently receiving pollution prevention purchasing assistance through the Mobile, AL, Corps of Engineers office.
- Problems with DMWRs and virgin material requirements add to costs and produce unnecessary wastes.

Point of Contact: Tim Garrett, Chief, Environmental Engineering Branch, Anniston Army Depot, ATTN: SDSAN-DEL-EMD, Anniston, AL 36201. tel. (205) 235-6350

CORPUS CHRISTI ARMY DEPOT (CCAD)

Location: Corpus Christi Naval Air Station, Texas

Size: 200 Acres, 4000 civilian personnel **Command:** AMC

Primary Mission: Repair and modernize aircraft

Operation Wastes: Sludges and solvent-contaminated wastewater from painting, paint stripping and plating

Pollution Prevention Project: Reduce chromium waste stream by alternative aluminum conversion coating process.

Previous Problems: Chromium is a toxic substance used to improve adhesion of paint to aluminum surfaces; chrome is usually applied through either an epoxy primer or a chrome plating. Plating creates cyanide and chromium waste for the treatment plant. Applying a primer creates chromium particles when the primer is removed.

New System Benefits: Chromium waste has fallen by more than 95 percent since 1985; depot has reduced total hazardous waste generation by over 50 percent since 1985. CCAD has also had success with alternative methods for paint removal by substituting plastic media blasting for solvent-rinse processes.

Information Source: Information came from trade shows and through the DESCOM-CTX program.

Project Support:

- Depot pollution prevention initiatives motivated by NOVs.
- Money from Waste Minimization Capitalization Account provided funds for pollution prevention improvements.
- Depot suggestion program beneficial in pollution prevention development.
- Borrowed manpower from various divisions provided necessary support for the Environmental Division.

Barriers to Success:

- Compliance emphasis inhibits pollution prevention program development.
- Shortage of environmental personnel prohibits dedicated pollution prevention effort.
- GS-12 level pay cap for engineers causes retainment and recruitment problems.
- Variance in pollution prevention project funding available each year inhibits program planning and purchasing options.
- DMWRs require virgin materials when recycled materials already available on base would be sufficient.
- Shipping wastes to DRMO created "out of sight out of mind" problem inhibiting waste prevention.
- Approval required from Aviation and Troop Support Command for each proposed material substitution created additional work and delays.
- Environmental Division concern about response of Industrial Risk office to pollution prevention efforts requires time for paperwork to guard against liability.

Point of Contact: Vic Verma, Chief, Environmental Division, Corpus Christi Army Depot, ATTN: SDSCC-HE, Corpus Christi, TX 78419. tel. (512) 939-2214

FITZSIMONS ARMY MEDICAL CENTER (FAMC), OPTICAL FABRICATION LABORATORY (OFL)

Location: Aurora, Colorado
Size: 576.5 acres, 4,500 employees **Command:** HSC

Primary Mission: Produce eyeglasses for active duty and retired military personnel

Operation Wastes: Highly corrosive alkaline liquid wastes (pH>12.5) containing lead and cadmium, spent solvent and ground glass fines (non-hazardous)

Pollution Prevention Project: Convert production process from glass to plastic lenses to eliminate the use of several hazardous materials.

Previous Problems: Lead and cadmium waste produced during the glass lens fabrication process was initially discharging directly into the installation waste stream; upon identification this was collected in drums and disposed as a hazardous waste. The waste accounted for 50 percent of FAMC's hazardous disposal costs (10.25 barrels per month costing about $180,000 per year).

New System Benefits: Toxic substances from glass lens fabrication process were eliminated by conversion to plastic lens fabrication, significantly reducing hazardous waste generation and disposal costs.

Information Source: Survey of eyeglass manufacturing industry by DEH contractor (Engineering-Science, Inc.)

Project Support:
- Waste minimization opportunity assessments (WMOA) accomplished through the USEPA WREAFS program (Waste Reduction Evaluation at Federal Sites).
- USAEHA-West requested by Preventative Medicine Activity at FAMC conducted separate study and determined the waste discharged from OFL was hazardous.
- Good cooperation and communication between Logistics and OFL helped procure new equipment and substitute materials, and Logistics was able to expedite the approval process.
- Funding from USATHAMA-HAZMIN.

Barriers to Success:
- AR 40-63 required military eyeglasses to be produced with glass lenses; private industry had long since switched to primarily plastic lens production.
- Lack of communication caused concern among employees over potential job losses due to conversion.
- High capital and operations cost created a funding hurdle.
- OFL was initially overlooked by environmental managers because waste went directly to central wastewater treatment plant — without WMOA, OFL waste may not have been discovered.

Point of Contact: Sue Errett, Environmental Coordinator, DEH FAMC, ATTN: HSHG-EH, Building 118, Aurora, CO 80045-5001 tel. (303) 361-3526

FORT LEWIS

Location: Fort Lewis, Washington

Size: 86,176 acres **Command:** FORSCOM

Primary Mission: FORSCOM Troop Installation — plan and prepare assigned and attached units for commitment to execute theater contingency plans

Operation Wastes: Contractor study identified 142 waste reduction opportunities involving paints and primers, antifreeze, solvents, photographic wastes, acid and alkaline processes, among others.

Pollution Prevention Project: Develop a pollution prevention program.

Previous Problems: Previous efforts to manage hazardous wastes have been end-of-pipe treatments or scattered instances of pollution prevention. Washington state law required Fort Lewis to develop a pollution prevention plan.

New System Benefits: Designated central full-time pollution prevention manager, developed a pollution prevention plan to systematically identify and address pollution prevention opportunities, and identified and reduced redundant and uncontrolled local procurement; implementation of computerized material tracking system will further reduce waste.

Information Source: Contractor conducted survey.

Project Support:

- Pollution prevention plan mandated by state law (Washington State's Hazardous Waste Reduction Act of 1990). Pollution prevention is compliance in this case.
- Command supported the program.
- Fort Lewis pollution prevention team lead by a designated pollution prevention manager.
- Institutional support provided by the Environmental Engineering Branch located within Directorate of Engineering and Housing.
- Pollution prevention information disseminated throughout Fort Lewis and to other facilities by AEC and division newsletter.

Barriers to Success:

- Staff shortages have prevented concentration on pollution prevention activities even with a full-time pollution manager.
- Federal acquisition regulations are bare-compliance oriented and inhibit pollution prevention activities that attempt to plan for future compliance needs.
- Difficult relations with contracting office created implementation delays.
- Acting as host to regional DRMO artificially inflated figures for hazardous waste production — it also costs more for Fort Lewis to send waste to DRMO than it would to sell it to a local recycler, but AR 200-1 mandates deposit in DRMO and blocks any alternative.
- Fort Lewis' environmental offices initially lacked comprehensive information about facility wastes.
- There is no representative from DRMO on the pollution prevention team.

Point of Contact: Cynthia Trout, Pollution Prevention Manager, Headquarters, I Corps and Fort Lewis, ATTN: AFZH-DEQ, Fort Lewis, WA 98433 tel. (206) 967-5646

LIMA ARMY TANK PLANT (LATP)

Location: Lima, Ohio

Size: 369 acres **Command:** AMC

Primary Mission: Manufacture M1A1 Abrams Main Battle Tank (GOCO facility)

Operation Wastes: CFCs

Pollution Prevention Project: Change dye-penetrant weld inspection method to replace 1,1,1 trichloroethane with a magnetic particle process.

Previous Problems: 1,1,1 trichloroethane is an ozone-depleting substance that will soon be out of commercial production. The previous weld inspection method used application of this CFC to identify defective welds.

New System Benefits: 1,1,1 trichloroethane use is limited to approximately 10 percent of the tank hull welds, saving over $100,000 annually and reducing the chemical pollution level by 44,000 pounds; less time is required to inspect a weld and quality of inspection has been improved.

Information Source: Contractor personnel familiar with technology made adjustments for use on tank hull welds.

Project Support:

- Institutional support came from two internal committees involved in environmental problems at LATP, the Material Substitution Committee and the Hazardous Material Minimization Committee, which both meet on an ad hoc basis.
- The government environmental office at LATP was very supportive and worked closely with the operating contractor (GDLS) to accomplish hardware modifications and reconfigure power supply layout for operation of the new equipment.
- Good employee access to command for pollution prevention suggestions enabled this plan as an option.
- The process was aided by exceptional relations between commander and all subordinate government personnel on the government side and operating contractor and employees on production side.
- Milspecs included magnetic particle inspection as an alternative, so higher approval was not an obstacle.

Barriers to Success:

- Employees were content with the system as it was and did not enjoy a change to heavier, more awkward equipment.
- There was initial employee concern about job elimination due to reduced time requirements; GDLS assured employees that this would not occur.

Point of Contact: Cletus J. Hoersten, Senior Facilities Engineer, General Dynamics, Land Systems Division, 1161 Buckeye Road, Lima, Ohio 45804-1825. tel. (419) 221-8318

MILAN ARMY AMMUNITION PLANT (MAAP)

Location: Gibson and Carroll counties, western Tennessee

Size: 22,436 acres **Command:** AMC

Primary Mission: Load, assemble and pack ammunition items (GOCO facility)

Operation Wastes: Waste explosives; explosive-laden sludge; explosive-laden water (pinkwater) containing TNT, RDX, Composition B, Composition A, and other explosives; and spent carbon from pinkwater treatment plants

Pollution Prevention Project: Reduce pinkwater generation through pinkwater recirculation and by converting a wet vacuum system to dry.

Previous Problems: Pinkwater generated during the washout of explosive charges from projectiles, from building and equipment washdown done to remove gross explosive contamination, and from wet vacuum systems was sent into the facility treatment plant and constituted 99 percent of MAAP wastes by weight.

New System Benefits: These two projects significantly reduce pinkwater waste and generation. Dry vacuum conversion provided initiator material for ammunition destruction and made the system easier for workers to clean and operate; the recirculation project saved roughly 800,000 gallons of water in the 1986-87 production cycle.

Information Source: Existing in-house technology identified by long-time employees: one staff officer and one base contractor employee.

Project Support:

- Cooperative spirit between GOCO staff and Army was helpful in facilitating the change.
- Contractor had an incentive to cut costs to remain competitive.
- Plant Institutional support for environmental projects from the ACO Environmental office (ensures compliance with Army policies), the Environmental Quality Control Committee (composed of engineers and other representatives from both offices) and the MAAP Environmental Office (involved in an oversight capacity).
- Funding for early phases of the recirculation project was provided by the Army Research and Development Command (ARRADCOM) Materials Management and Technology account; this command has since been deactivated.
- Funding for the vacuum conversion project was obtained through intervention by a Major at AMC who found money in special HAZMIN account — total allowance was $290,000 (June 1989).

Barriers to Success:

- Vacuum system conversion: the problem was not considered essential to continued operations and was not for specific compliance goal, so funding was not available through normal channels.
- Safety requirements called for approval from DoD Explosives Safety Board, AMC Field Safety Activity and Army Technical Center for Explosives Safety. These created lengthy delays.
- Recirculation project: this process change put MAAP well under compliance requirements for NPDES system, but EPA has promulgated even tighter restrictions beyond what MAAP can currently meet. This could affect its next NPDES permit.

Point of Contact: Patrick Brew, Chief Facilities Engineering Division, Milan Army Ammunition Plant, ATTN: SMCMI - EN, Milan, TN 38358. tel.(901) 686-6251

MISSISSIPPI ARMY NATIONAL GUARD (MSARNG) MOBILIZATION AND TRAINING EQUIPMENT SITE (MATES)

Location: Camp Shelby, Long Leaf Pine Hills of South Mississippi

Size: 132,000 acres **Command:** ARNG

Primary Mission: Maintain military vehicles

Operation Wastes: Degreasing solvents and contaminated fuel

Pollution Prevention Project: Use filtration technology to reduce waste from degreasing operations.

Previous Problems: Eighty-five percent of Camp Shelby's waste historically came from automotive cleaning processes and contaminated fuel.

New System Benefits: Filter systems completely eliminated the need to dispose of contaminated diesel fuel and reduced amount of maintenance time required per tank; pollution prevention changes prompted additional improvements in other MSARNG facilities.

Information Source: Unsolicited presentation of filter method by manufacturer's sales representative.

Project Support:

- Support from top management and workforce, good lines of communication, and use of off-the-shelf technology for improvement.
- Camp Shelby has its own environmental office that responds to camp-specific environmental issues.

Barriers to Success: No serious problems.

Point of Contact: 2LT Francis Coulters, Hazardous Waste Specialist, MS Military Department, ATTN: FMO-E, PO Box 5027, Jackson, MS, 39505. tel. (601) 973-6229

MISSISSIPPI ARMY NATIONAL GUARD (MSARNG) AVIATION CLASSIFICATION AND REPAIR ACTIVITY DEPOT (AVCRAD)

Location: Gulfport-Biloxi Regional Airport, Mississippi **Command:** ARNG

Primary Mission: Maintain, service and repair helicopters and fixed-wing aircraft

Operation Wastes: Chemical paint stripping solutions and various solvents used for parts cleaning

Pollution Prevention Project: Reduce solvent wastes through installation of plastic-media blasting paint stripping system, material substitution and filtration.

Previous Problems: Overhaul work generated a variety of waste streams and used 80,000 gallons of paint stripper per year.

New System Benefits: Cost of hazardous waste disposal expected to decrease from $440,000 to $50,000 between 1991 and 1993; one aircraft's wastes from stripping now fit into one 250-pound drum of non-toxic dust, paint chips and plastic. AVCRAD's changes alone achieved a 50 percent reduction for all of MSARNG. Time required to strip an aircraft was reduced by 10 percent.
Information Source: An intensive search for paint stripping alternatives identified this system at Corpus Christi Army Depot.

Project Support:
- Commander took unique role in personally initiating and overseeing pollution prevention changes.
- HQ office in Jackson provides environmental support from additional duty assignments; General Foreman at AVCRAD leads an environmental council consisting of AVCRAD employees.

Barrier to Success: Quick Return Investment Program (QRIP) and Productivity Enhancement Capital Investment Program (PECIP) funds were both denied. It took three years to get $165,000 to fund a project that would save an estimated $300,000 annually. Money finally came from the National Guard Bureau's environmental funds.

Point of Contact: 2LT Francis Coulters, Hazardous Waste Specialist, MS Military Department, ATTN: FMO-E, PO Box 5027, Jackson, MS, 39505. tel. (601) 973-6229

Appendix B:
Chart of Case Study Issues

Issues	ANAD	CCAD	FAMC	Ft. Lewis	LATP	MAAP	MSARNG
Management Considerations							
Strong command/management project support	■		■	■	■		■
Personal involvement by commander	■						■
Difficult for P2 managers to access command		■					
Shortage of dedicated P2 manpower	■	■		■			
Assistance through borrowed manpower		■					
Utilized preapproved technology in P2 project					■	■	
Tech. information provided through govt. office		■					
Information through trade shows & conferences	■	■	■				
Information provided through DESCOM - CTX	■			■			
Effort to educate work force on P2 benefits	■	■		■	■		
Contributions from suggestion program	■	■		■	■	■	
Decisions decentralized to level of involvement							■
Perception of arbitrary decision making by AMC	■						
Funding							
Funding main challenge in system development							■
Provided through DESCOM - CTX program	■	■		■			
Provided through WMCA Capitalization Account		■					
Provided through intervention of indiv. at AMC						■	
Provided through USATHAMA - HAZMIN			■				
Denied - project exceeded 50% reduction goal						■	■
Denied - not crucial to continued operation						■	
"Use or lose" problems	■						
Difficulties with multi-year purchases	■						
Obligated purchase through Dist. CE office	■						
Money received too late for adequate program planning	■						

Issues	ANAD	CCAD	FAMC	FT. LEWIS	LATP	MAAP	MSARNG
Motivation							
Strong individual leadership							■
Compliance with state legislation				■			
Response to reduction mandates from higher HQ							■
Motivated by NOVs	■	■				■	
Compliance criterion in performance appraisals	■						
Employee awards program	■	■					
Concern over impending material usage problems					■	■	■
Competitive advantage						■	
Procurement							
Acquisition regulations	■			■		■	
Expiration of funding and obligation deadlines	■	■				■	
DMWR virgin material requirements	■	■	■				
Approval process for product changes	■	■					
Redundant and uncontrolled local procurement				■			
Sole source purchase of P2 equipment	■						
Use of off-the-shelf technology					■	■	■
Other Factors							
Production rate and game rule change difficulties		■				■	
Employee resistance due to lack of communication			■	■			
"Organizationally mature" employee contribution			■		■		
Problems with DRMO recycling/accountability				■			
Use of existing technology	■	■	■	■	■	■	■

Appendix C:
Sample Survey Questionnaire

This questionnaire was used as a guide for interviewing appropriate people in gathering information for the pollution prevention case studies.

A. General Description

1 Describe your original goals and the changes you have accomplished.

2 How was this problem or opportunity identified? How are most environmental problems in your installation identified?

3a Which, if any of these issues are involved: water quality, air quality, hazardous materials or hazardous wastes, solid wastes?

3b Which is your primary target?

4 How is the problem you addressed Army or armed forces specific?

5 Describe any special aspects of this project that were difficult to deal with. Why were they difficult?

B. Process of development

1a What factors motivated this improvement? Was it motivated by any particular compliance act? What role did it play? Was there any directive? From whom?

1b Has the facility ever been cited for problems or given a notice of violation by EPA, higher HQ inspections, internal audits or any other enforcement agency? In what way did this influence the decision? What interaction, if any, did the environmental office have?

2a Who was responsible for initiating this change and who organized and carried it out? (name, rank/grade, job title) Why did this person take the lead? (most familiar with process, best qualified, etc)

2b How has the chain of command or decision making process been an issue in slowing or assisting the improvement? Did the commander/DEH/environmental coordinator support or hinder the process? How did you get around or make use of the situation?

3 Did public opinion have anything to do with the change? What level of public was involved? (local, regional, national) If it was a political issue, what political officials got involved and what was their involvement? Was the public/political involvement helpful or a hinderance?

4 In what way has the procurement process (local and DA centralized) put limitations on decisions for the changes? Have any particular army regulations been especially difficult to work with or impaired your efforts to prevent pollution? Have any helped?

5 What incentives exist to reduce waste or improve management of material usage?

6 Does a regular review process provide you with information on outputs and waste production? Who is involved in this review? Does it lead to ideas on reduction? Give some examples.

7 What other approaches were identified and evaluated as candidate solutions, and what criteria were used to select the approach finally used?

C. Technical Details

1a Where did the technical information needed for this change come from? Please name the specific source and contributing sources. (In house, production line, contractor, staff office, innovative solution, imported solution, other)

1b To what new research information do you have access, and how have you used new information here?

1c Has finding information for this been difficult? How have you solved this?

2 Describe how any anticipated or unanticipated barriers hampered your attempts and where they originated. (unsupportive command staff, lack of funding, lack of technology, etc.)

3 Please expand on the details of this case.

4 How does this improvement involve either in-process or out-of-process recycled materials?

5 What has been the public or political response to the changes that have been made?

6 What process was used in the technical analysis of the problem? (process flow diagram? mass/energy balance evaluation?)

D. Usefulness

1 Have the expectations of the change been realized? How have they been measured? Explain any unexpected improvements and additional unexpected problems?

2a What is the qualitative impact? Give details on how the improvement has affected: Raw material usage? Disposal capacity? Public relations? Health, safety, and the attitudes of those working with and responsible for the improvement?

2b What reductions have occurred in pollutant production? What affects have the reductions had on overall cost and on the time demands of staff members? Is there any affect on the total staff required?

E. Links to other efforts

1 What information from this improvement has been disseminated? To whom? In what format? Was dissemination required? Have you seen any information from other similar improvements as a result of your success? Where?

2 How has the knowledge been put into institutional memory (i.e how have "lessons learned" been recorded)?

3 Was staff training a goal of this procedure? What types and extent of training? Does the staff now have a greater understanding of environmental issues and the importance of protecting resource as a result of the improvement process? Has this created any positive spinoffs for the Army?

4 What further needs or improvements have you identified that you haven't yet been able to address? Do they relate directly to the original change? Why haven't you been able to address them?

5 Describe limitations you anticipate due to increasing enforcement efforts? How will they create difficulties? Are you prepared to deal with them?

F. Other Environmental issues

These questions are more general in nature and are intended to give an idea of the context in which the pollution prevention improvement was conducted.

1) Information

Do you feel you are getting enough information on environmental issues and how they affect you? On ways to reduce wastes? What information would you like to have and be kept current on that you don't have access to? Who has this information?

2) Recycling/Reuse

a Have you recycled or recovered your wastes? What type of recycling/reuse? What have been the results?

b If you haven't recycled/reused, what has prevented you?

c Have treatment costs been reduced by dividing and classifying wastes and pollutants as "regulated," "easily recyclable," and "difficult to treat" before they are treated?

3) Compliance

What difficulties have you experienced with compliance of regulatory statutes? What did you do?

4) Alternative Materials

Have you tried substituting raw materials in a production process to reduce the toxicity of processed materials? In which processes might this help? Where would you look for this information?

5) Waste Reduction

Do you incorporate an inventory control system or purchasing procedures that minimize unnecessary wastes?

6) Training

What personnel training and incentive programs do you use to deal with environmental wastes? Who gets the training? Have they helped?

7) Public Relations

Tell about any public relations or outreach programs you have regarding environmental issues? What kind of a response have they received?

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INDEX

A

B

C

D

E

F

H

I

L

M

N

O

P

Q

R

S

T

V

W

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