AFIT/GEE/ENV/94S-36

HIGH-GRADE PAPER RECYCLING:
A PROGRAM MANAGEMENT PERSPECTIVE

THESIS

Rodger L. Carter

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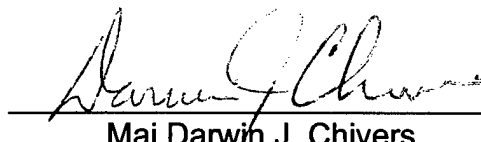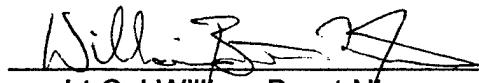Rodger L. Carter, CSP, CHCM, REM

Presented to the Faculty of the

Graduate School of Engineering

Of the Air Force Institute of Technology

In Partial Fulfillment of the Requirements for the Degree of

Master of Science in Engineering and Environmental Management

Lt Col Steven T. Lofgren
Member

Maj Darwin J. Chivers
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The opinions and conclusions in this thesis are those of the author and are not intended to represent the official position of the DoD, USAF, or any other government agency.

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Abstract

     Recycling of high-grade paper is one method of reducing the use of natural resources and the amount of waste being emitted into the environment, both in the process of manufacturing and in the disposal of unneeded documents. The Air Force Materiel Command (AFMC) is a significant user of high-grade paper, thus recycling represents a potential saving to society in the form of lessened negative impact on the environment as the result of AFMC operations. The possibility also exists for AFMC to reduce operating costs.

     The purpose of this study is to explore means of reducing high-grade paper disposal by AFMC, examine program management of high-grade paper recycling by AFMC, and apply effective program management processes to the AFMC high-grade paper recycling program.

     Results of the study indicate that the AFMC high-grade paper recycling program is receiving relatively little emphasis and that the data being collected are insufficient to accurately assess actual recycling program performance. The available data indicate that high-grade paper is being recycled at a much lower rate than the national average, largely in response to Air Force policy that recycling programs are to be funded only to the extent that income equals or exceeds costs—they must pay for themselves. This study suggests that this philosophy be re-examined and that various management improvements could be implemented in order to enhance program performance.

HIGH-GRADE PAPER RECYCLING:
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I. Introduction

Problem Statement

The current Air Force Materiel Command (AFMC) recycling program for high-grade paper, while complying with all Air Force regulatory requirements, may be providing results which are less than satisfactory when compared to municipal and industrial programs. Air Force bases currently report recycling data only in pounds of material recycled versus pounds of material disposed. This data includes very heavy materials such as scrap metal sold by Defense Reutilization Marketing Office (DRMO) facilities. In 1995, Wright-Patterson Air Force Base (WPAFB) reported 3,600 tons of materials recycled, but 2,400 tons of that was scrap metal sold by DRMO (Meinerding, 1996). Such heavy materials result in overall recycling rates which compare favorably to national rates in terms of pounds recycled of total pounds of waste generated, but this metric does not provide information concerning individual categories of recyclables such as paper, plastic, aluminum, or glass.

Background

The McGraw-Hill Recycling Handbook (Lund:B.15, 1993) defines high-grade paper as "relatively valuable types of paper such as computer printout,

white ledger, and tab cards. Also used to refer to industrial trimmings at paper mills that are recycled." A 1993 contractor study of the WPAFB solid waste management program defined high-grade paper as consisting "mainly of white bond paper, typing paper, copy paper, printer paper, and computer printout paper" (Battelle:41, 1993). The WPAFB Qualified Recycling Plan lists acceptable recycling paper other than cardboard and newspaper as "typing paper, writing paper, photocopy paper, computer paper, and scratch paper" (DAF:10, 1995c). High-grade paper, then, consists of the more expensive types of paper in use which are separated from cheaper grades of paper such as cardboard, newspaper, colored paper, wrapping paper, and other such paper products that are sorted separately for recycling purposes. High-grade paper products cost more initially and are sold for higher prices on the recycling market than are lower grades of paper (Meinerding, 1996).

Under Section 6602(b) of the Pollution Prevention Act of 1990 (USC, 1990), Congress established a preferred hierarchy of options for reducing waste. This hierarchy places prevention and reduction at the top followed by recycling and reuse, treatment, and disposal. The Air Force Resource Recovery & Recycling Program Guide (DAF:1-4, 1995b) states that recycling percentage is the metric which is used to judge the effectiveness of recycling efforts. This performance indicator measures recycled/reused amounts as a percentage of total waste generated. The desired trend is an increase in the annual recycling percentage (DAF:1-4, 1995b).

According to the American Forest & Paper Association (AFPA, 1996), current production of paper products in the U.S. is approximately 100 million tons annually, with about 30 million tons of that being high-grade paper. Data provided by the Environmental Protection Agency (EPA, 1998) indicate that 75 percent of the high-grade paper is discarded rather than being recycled. Data obtained from the WPAFB recycling program manager indicate a total paper product recycling rate of 39 percent with a high-grade paper recycling rate of approximately 10 percent (Meinerding, 1996). The WPAFB recycling program manager and recycling center personnel monitor employee practices by periodically performing waste disposal container sampling. One such sampling in 1998 found that about 20 percent by volume of the material in a large waste container located near the AFMC Headquarters building was high-grade paper (Kesner, 1998).

Implications of Paper Recycling. One environmental organization, the National Resources Defense Council (NRDC, 1997) reports that the production of paper from virgin pulp results in the release of large amounts of environmental pollutants including furans, chlorinated dioxins, chloroform, absorbable organic halides, methylene chloride, trichlorophenols, pentachlorophenols, sulfur compounds, solid waste, contaminated sludge, noxious odors, water discoloring agents, various volatile organic compounds, significant quantities of hazardous air pollutants, and ozone producing chemicals. In contrast, modern paper recycling mills produce virtually no hazardous air or water pollution. Further, 80 to 85 percent of recovered paper becomes part of the final product with only

about 15 to 20 percent of the material becoming waste, none of it toxic. This compares to an average of about 25 percent of a harvested tree which becomes part of the final paper product.

The NRDC states that the effect on American forestry is also significant. They say that only about 20 percent of paper manufactured in the U.S. comes from tree farms, farms which do not provide the ecological diversity of a natural forest. The other 80 percent is produced from natural forests, resulting in a large loss of natural habitat for wildlife.

Recycling Economics. Economics is necessarily an important consideration in the conduct of a recycling program because one or more agencies in the chain between the end user of a recyclable product and the organization which will recycle the material are often commercial businesses which must achieve a profit, or at least break even, to stay in business. Not-for-profit organizations such as the Air Force can disregard the cost of their own recycling operations if they wish to do so; however, the best of recycling programs may be of little value if there is no market available to accept the materials being collected.

Research Objective

The objective of this research is to explore means of reducing high-grade paper procurement by AFMC, examine program management of high-grade paper recycling by AFMC, and apply effective program management processes

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to the AFMC high-grade paper recycling program. Investigative questions in support of this goal are:

1. What high-grade paper recycling data are currently being collected by the AFMC; what data would it be appropriate to collect in order to provide an accurate picture of actual high-grade paper recycling performance; and what practical means can be used to collect such data?

2. What best management practices could be implemented to improve high-grade paper recycling program performance?

Prior to investigating these research questions, a preliminary question regarding resource reduction will be considered to determine whether and to what extent high-grade paper recycling needs to be addressed at all on a programmatic or organizational policy level. Continued progress in developing processes which eliminate the requirement for high-grade paper could obviate resolution of research questions 1 and 2.

Scope of Research

The focus of this thesis will be the AFMC high-grade paper-recycling program and related Air Staff policies and procedures. High-grade paper recycling has been chosen because, unlike plastic and metal containers or newspapers, high-grade paper is purchased directly by the Air Force. Also, high-grade paper is purchased in large quantities and represents a significant expense to the Air Force--more than 550 tons per year at WPAFB alone according to Mr. John Bigl (Bigl, 1996), director of the WPAFB Defense Printing

Service Detachment Office. Recommendations of the study may be equally applicable to the recycling of other solid waste materials as well as to the entire Air Force recycling program.

Significance of Research

Management recommendations concerning high-grade paper recycling will be applicable to all Command solid waste recycling programs as well as the overall Air Force recycling program. Optimally, the recommendations of the study will be implemented by AFMC and the Air Staff, thereby improving performance of recycling programs throughout the Air Force. This, in turn, would mean improved economic benefits, reduction in use of limited national resources, reduction in energy requirements, reduction in landfill requirements, reduced air and water pollution, and improved public image for the Air Force. Minimally, it is expected that many of the recommendations would be adopted by AFMC, a large user of high-grade paper and generator of significant amounts of solid waste.

II   Background

Source Reduction.

Under Section 6602(b) of the Pollution Prevention Act of 1990 (USC, 1990), Congress established a national policy that:

> pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

This hierarchy of preferred options places prevention and reduction at the top followed by recycling and reuse, treatment, and as a last resort, disposal. E.O. 13101 (OP, 1998) further states that pollution prevention means source reduction. Source reduction involves reducing the need for a particular material by substituting other more efficient or less costly/hazardous suitable materials, changing specifications, changing processes, or otherwise making manufacturing or marketing changes which lower the requirements for the material. Source reduction is especially desirable when the material in question is either nonrenewable or hazardous in nature. Source reduction, as related to high-grade paper, may involve various ways of saving paper or possibility eliminating its use altogether. This last concept is commonly referred to as the "paperless office." Two examples of this concept are computer programs developed by the Air Force Joint Strike Fighter (JSF) Program Office (formerly

JAST—Joint Advanced Strike Technology). The JSF is the Department of

Defense's focal point for defining affordable next generation strike aircraft

weapons systems for the Navy, Air Force, Marines, and U.S. allies. The

focus of the program is affordability--reducing the development cost,

production cost, and cost of ownership of the JSF aircraft. One method of

reducing costs for the program is to develop paperless acquisition tools.

The JSF has developed new computer software specifically to

electronically replace paper requirements (DAF, 1996c). The software

programs are the Bids Evaluation Support Tool (BEST), and the

Contracting Officer Support Tool (COST).

The software used by the JSF program was tailored to meet specific

program needs. The software contains worksheets and summary screens to

support source selection. Key features include the use of a bulletin board system

to exchange contracts between the program office and the contractor, and the

use of an electronic signature software program. Through the use of these

programs, the JSF Program Office has been able to electronically complete its

entire contracting process, from solicitation to the signing of contracts as shown

in Figure 1. All information needed to download and utilize these programs is

posted on the Internet (www.jast.mil). They allow shared electronic databases,

on-line access to contractor management information systems, and electronic

deliverables.
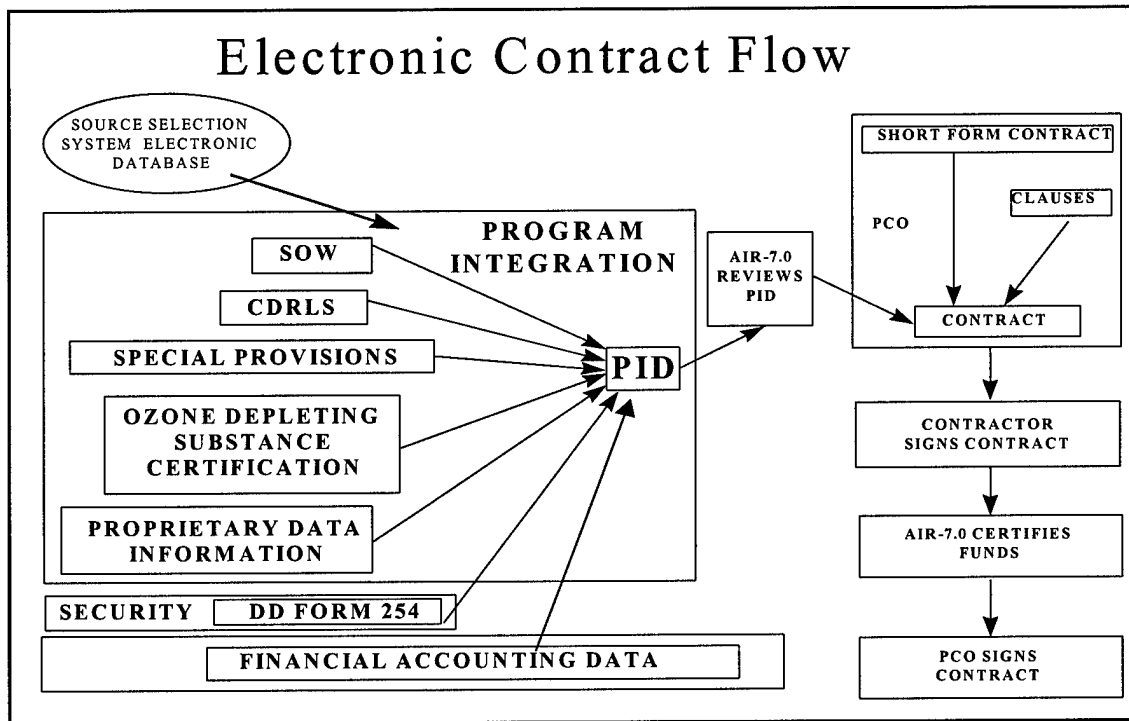
Figure 1. Paperless Contracting Data Flow (DAF JAST Program)

The BEST software program is designed to be a paperless source selection process, i.e., support all aspects of source selection. It has the following features:

Input and display of proposed data

Evaluation worksheets

Decision support tools

Record and display evaluation status

Question and answer support tools

Generation and display reports

The COST software program is a custom-designed software application used by JSF to support electronic contracting. It includes:

Procurement Initiation Document (PID) Generation and Display

Security Form DD 254

Contract Data Requirements List (CDRL)

Statement of Work (SOW)

Financial Accounting Data Sheet

Ozone Depleting Substance Form

Short Form Research Contract (SFRC)

The JSF Program Office uses the World Wide Web for a variety of purposes which support their paperless office concept:

General program information

Calendars

Procurement and award announcements

Briefings

Dissemination of newsletters, avionics architecture, and the master plan

Distribution of electronic contracting and evaluation tools

Answering source selection questions

The JSF Program Office has experienced the following process benefits:

1. Manpower--Simplified management and documentation--one administrator instead of the four previously required--50 less technical and cost advisors required.

2. Time--Fast technical and cost evaluation—three to five days versus four to six weeks

3. Paper--Over 130,000 pages saved

The JSF Program Office has made their paperless office processes available to other Department of Defense (DoD) and government agencies. They state that the following agencies are now using JSF programs that have been adapted to the particular agencies' needs: Air Force, Navy, Coast Guard, FAA, and Canada.

The JSF is just one example of what can be done and the very significant results that can be achieved by developing software programs specifically designed for eliminating paperwork. Further, once such a program is developed, it can often be tailored to the needs of a wide variety of other users so that the initial developmental costs for each additional user are minimized. Learning from the initial experiences of the original developer can also serve to assist implementation in other organizations and agencies (DAF, 1996c).

Sherman (1997) says that the concept of the paperless office which seemed imminent in the early 1980s has not come about as many thought it would. Facsimile machines and computer-operated printers have actually greatly increased the use of high-grade paper products. He says that companies which have not yet made a strong push for a paperless office often cite initial costs and the need for cooperation from everyone involved. Equipment costs are often very high and labor costs sometimes catch companies off guard. Cost justification is a critical issue with many companies—there must be sufficient payback on investment. Sherman found that decision-makers are sometimes second-guessed years later when a change in upper management takes place and that some companies dismissed individuals because a new boss did not

concur with a past decision. He says, however, that companies which have adopted paperless office techniques report a several valuable benefits. Employees can have simultaneous access to electronic documents whereas a paper-based process usually forces serial work. He says one company reported that before adoption of electronic procedures they spent 75 percent of their time tracking paper documents. Sherman includes security as a benefit of electronic filing, saying that the use of file access permissions and digital signatures provide audit trails for revision control so that a history can be kept of changes to a document and who made them. Other benefits listed by Sherman include easy duplication, global transferability, protection from environmental damage such as coffee spills, easy backup, reduced use of energy and reduced use of natural resources.

Paper-Saving Methods. Use of special computer programs is one way in which the concept of source reduction may be implemented. Many other paper-saving methods of major and minor significance are also possible. Several possible methods to reduce the need for paper include the following:

1. Double-sided photocopying. When extra copies of a document are required, they are often printed on one side only. Taking the trouble to print double-sided would cut paper requirements almost in half. Academic institutions generally require term papers and theses be double-spaced as well as printed on one side only. These two requirements mean that the amount of paper used is quadrupled, not only in preparing the final product, but most probably in draft

copies also. A no-thesis option or electronic submittal would save large amounts of paper if adopted nationally.

2. Double-sided printing. Although many people may not be aware of it, most printers can print back-to-back, thus even drafts and one-off documents could be printed with paper savings of up to 50 percent. Microsoft Word (MS Word) is one of the most common word processing programs used throughout the Air Force. Users of this program can print double-sided documents; however, it is necessary for the operator to complete five steps (MS Word 97):

1. Select PRINT from file menu

2. Select PROPERTIES button

3. Select PAPER tab

4. Select MORE OPTIONS

5. Select FLIP ON LONG EDGE

The more expensive commercial grade computer printers (as opposed to less expensive models primarily sold for in-home use) have the capability to flip pages automatically when the double-sided print option is selected. Unfortunately, lengthy selection procedures as noted above may discourage wide use of this capability.

3. Type size, font, and margins. Twelve-point type is normally used in Air Force documents, but 10 point is commonly used elsewhere and is easily readable, and nine point, while somewhat small, is still easy to read with normal vision. A normal 16-page single-spaced document with 12-point type and standard margins (one inch at top and bottom and 1 ¼ inch at sides) if changed

to ½ inch margins on all sides would print out as 12 pages, a 25 percent reduction in paper requirements. If the font was changed to 9-point as well, the same document would print about 7 1/8 pages of text (8 sheets of paper), a 50 percent reduction in paper requirements. If the original paragraphs were to be double-spaced, the paper savings would be closer to 80 percent.

Font is also important. For example, if this thesis were printed with the Courier font instead of the Arial font, its page length would increase by approximately 14 percent

4. Multiple slides per page. The Microsoft PowerPoint program used for most slides produced by Air Force organizations can print 2, 3, or 6 slides per page by selecting PRINT from the file menu and then selecting the PRINT WHAT drop down menu. Most other slide programs have a similar capability. Since these hard copies are viewed as any other printed document, most briefings will be quite readable printed 6 slide to the page. If a briefing contains slides with very fine detail they can be printed 2 slides per page. In either case, significant paper savings will result.

5. Reuse of printed-paper. Paper that has already been printed on one side can be used for drafts. Personal observation and experience indicates that many drafts are normally produced before a document is ready to go final. All those drafts represent large amounts of wasted paper. Instead, drafts could be printed on the back of used paper either by selecting a special printer which contained only used paper, or by using a designated tray of a multiple-tray printer. On Hewlett Packard printers which are commonly available in the Air

Force, an upper or lower tray can be selected by choosing PRINT from the file menu, OPTIONS, then the DEFAULT TRAY drop down menu.

6. Training. Ensuring all employees are aware of how to use the paper-saving features of all office equipment will prevent wastage that may occur merely because employees do not know about certain paper-saving features of their programs or hardware.

7. Electronic communication. Using electronic mail or telephone whenever practical can save considerable paper. Most government and business organizations now have e-mail addresses. Faxes can now be sent from computers without making a paper copy first.

8. Requirement control. Limiting copies to only those necessary saves paper. For briefings and other purposes, handouts copies can be made upon request rather than automatically providing copies for all.

9. Recycling convenience. Ensuring that paper-recycling boxes are present at every workstation adds convenience and a simple adjustment such as reducing the distance an employee has to travel to discard recyclables can make a significant difference in employee participation.

10. Fax methods. Print fax cover sheets on the clean side of used paper, or use small fax stickers on the first page of messages so that a fax cover is not required.

11. Coordination procedures. E-mailing documents to reviewers or approving officials for editing/approval reduces the need for hard copies.

12. Editing. Editing documents on-screen rather than from a hard copy reduces the need for paper.

13. Reduce distribution requirements. Circulating documents (if a hard copy is required) rather than making copies for each reader saves paper.

14. Electronic data storage. Using floppy disks or compact disks (CDs) to store files rather than hard copies in file drawers not only saves paper; it saves storage space, facilitates searching, and allows easy electronic transmittal. The CD is a relatively new capability which has the potential of revolutionizing records storage. Thousands of pages of written material as well as photographic images or drawings can be stored on a single disk. The material can also be electronically indexed so that those individual documents can be quickly found. Searching by topic or word can also be done; features that can decrease research effort a thousand-fold. Commercially produced CD have been in use for some time now in libraries throughout the nation, including the AFIT library, and have greatly simplified research work for students. This same CD producing-capability is now readily available at relatively small cost for any organization which chooses to make use of this technology.

15. Document printing. When printing regulations or other documents from computer systems, printing only the portions that are absolutely needed for the task at hand rather than the entire document will save paper.

16. Information dissemination. Using e-mail for posting information rather than placing hard copies on bulletin boards will save paper.

17. Electronic forms. The Massachusetts Institute of Technology has just announced that admissions applications will now only be accepted when submitted electronically (CNN, 1998). The Air Force has now made most Air Force Forms available on the web. These forms can be completed on the computer, and then, in many cases, submitted electronically. As these types of programs become more prevalent nationally, the need for paper will be reduced accordingly.

18. Electronic submission. Submitting as many forms, reports, and data sheets as possible electronically will save paper. For example, many AFIT course reports might be submitted electronically thereby saving large amounts of paper.

19. Distribution control. Limiting reports to essential distribution only will save paper.

20. File control. Limiting hard copy file storage only to documents which have been reviewed and determined to be necessary will save paper. For example, not requiring copies of meeting minutes or reports from subordinate units to be filed if those documents are not being referenced by anyone nor serving any useful purpose by being filed.

21. Paper reuse. Using waste paper for notes rather than purchasing note tablets or colored stick-em notes which are difficult to recycle will save paper.

22. Storage of electronic documents. Saving e-mail documents and messages to disk rather than storing hard copies will save paper.

23. Editing control. Resisting the temptation to perform unnecessary editing can save paper. Every person has a different style of writing, but not necessarily better than the original writer. Numerous rewrites each time a draft document passes up the chain can waste a lot of paper as well as employee time.

24. Electronic distribution. The use of electronic mail can replace the use of hard copies wherever practical thereby saving large amounts of paper. Programs now exist for transmitting signatures as well as documents, therefore there may little reason to send hard copies (previously, the requirement to have a signature on a document was an impediment to the use of electronic mail). When the material is received, it can be copied directly to hard drive storage or disk storage. Any person needing to review the material can do so at a computer terminal. Documents that are currently being coordinated in hard copy form could be distributed and coordinated electronically instead. Implementation of an aggressive electronic mail program can not only reduce paper requirements, but also appreciably improve storage efficiency on the receiver's end.

The Paper Acquisition Process. According to the American Forest & Paper Association (AFPA, 1996), in 1995, paper use in the U.S. reached a total of 96 million tons per year. At an average of 17 trees per ton, this equates to a harvest of 1.632 billion trees annually, or about 13,000 square miles of forest (ReThink Paper, 1996). Approximately 27 million tons of the annual U.S. paper production is high-grade paper such as computer, printer, copy machine, and

white notepad paper (AFPA, 1994). The typical US office worker uses about 10,000 sheets of this high-grade paper each year (ReThink Paper, 1996).

According to the Environmental Media Association (EMA, 1996a), Americans discard about 85 percent of the office paper they use, approximately 7 million tons annually. They state that the manufacture of paper is an energy and water intensive process with the paper industry ranking third in energy consumption. Further, paper manufacturing results in over 100,000 tons of sulfur dioxide air emissions, the principal cause of acid rain, as well as discharging over 900,000 tons of toxic water pollutants into rivers each year. The U.S. Environmental Protection Agency (EPA), reports that before recycling, discarded paper products account for about 44 percent of the municipal solid waste of about 220 million tons (EPA MSW Factbook, 1996). Current recycling programs reduce this percent so that paper products account for about 33 percent of the materials that are actually incinerated or buried. About 43.3 million tons of paper are currently being recovered nationally, a rate of 45 percent (AFPA, 1996). Even with recycling, about 53 million tons of paper are still incinerated or buried. The 53 million tons not being recycled represents an additional annual requirement for forest products of about 900 million trees (17 trees/ton × 53,000,000).

The EMA (1996b) estimates that almost 500 billion photocopies are made annually in the U.S. They state that in addition to consuming large amounts of electrical power, more per unit than any other type of office equipment, photocopiers are also responsible for manufacturing and disposal wastes, toxic

materials in toner cartridges, and ozone emissions from the fusing process.

Much of the current use of paper is by computer printer. According to the EMA (1996c), sales of printers are now in excess of 11 million units per year. They also state that (EMA, 1996d) that facsimile machines account for large amounts of paper use with more than 300 million rolls of facsimile paper sold annually (EMA, 1996d) and that many new machines now use high-grade printer paper thereby increasing the already massive demand for the product.

The staff of ReThink Paper (1996), report that the need for paper accounts for a US paper pulp requirement equal to all the rest of the world's countries combined. Manufacture of this much pulp requires an annual harvest of 1.6 billion trees, 672 billion gallons of water, 403.2 billion kilowatt hours of electricity, and 37.4 billion gallons of oil. It also results in 5.8 billion pounds of pollutants released into the atmosphere and the need for 288 million cubic yards of landfill space to contain the associated waste.

Figure 2 provides additional data concerning the use of paper within the united States and the results of this usage in terms of trees required to fulfill the demand, landfill requirements, water requirements, energy requirements, and pollution emissions. The chart emphasizes the benefits in these categories when virgin pulp is replaced by recycled paper.

☛ The average American uses 681 pounds of paper a year

☛ The average U.S. office worker uses 10,000 sheets of paper annually.

☛ 96,000,000 tons of paper are consumed annually in the U.S.

☛ It takes 75,000 trees to produce one Sunday edition of The N Y Times.

☛ U.S. pulp mills consume 12,430 square miles of forest annually

☛ The U.S. with 5% of world's population produces 50% of all wood pulp.

☛ Time required for a southern pine to reach maturity: 14-16 years.

☛ Recycling one ton of paper saves:

   ✎ 17 trees

   ✎ 3 cubic yards of landfill space

   ✎ 7,000 gallons of water

   ✎ 4,200 kwh of electricity

   ✎ 390 gallons of oil

   ✎ 60 pounds of air pollutants

☛ Paper produced by recycling create 74% less air pollution, 35% less water pollution, and 75% less energy use than producing paper from virgin fibers.

☛ Only 5% of original woodlands remain in North America.

☛ Every Sunday, more than 500,000 trees are required to produce the 88% of newspapers that are not recycled.

Figure 2.   Paper Facts (ReThink Paper, 1996)

Copier Paper. Paper for copiers is considered to be high-grade paper even though it may contain 20 percent or more post-consumer paper. Post-consumer paper is paper that has been used by a consumer and then returned for recycling. The term "recycled paper" is often used in the industry to specifically mean paper scraps than have been reused in the paper manufacturing process and thus is differentiated from post-consumer paper. In general, however, the term "recycled paper" means both types and that is the way the term is used throughout this study.

Information concerning the purchasing of copier paper was provided by Mr. Dick Balk of the HQ AFMC Communications and Information Directorate (HQ AFMC/SI). According to Mr. Balk, Air Force organizations may order copy paper either from the General Services Administration (GSA) or from local vendors. Purchasing can be done by individual offices using an IMPAC credit card (International Merchant Purchase Authorization Card), or specifically designated offices can purchase paper for a number of offices. Previously, base customer supply stores were operated whereby supply custodians could shop for paper and other supplies and charge cost to their supply account. In order to assist in Air Force personnel downsizing, those supply outlets were eliminated (Balk, 1996).

GSA customers can place their orders by contacting GSA directly and charging purchases to their office IMPAC accounts. GSA operates large warehouses in various major cities and ships paper and other supply items to Air

Force bases by commercial transport companies. The orders generally arrive within two or three days. Headquarters Air Force Materiel Command (HQ AFMC) uses a centralized paper ordering system for most of its copiers (Balk, 1996). Leased copiers in HQ AFMC (29 copiers at present) use paper ordered through a paper copier manager as shown in Figure 3. The 29 copiers are part of an overall WAFB contract which covers about 600 copiers.

High-Grade Paper Acquisition
Wright-Patterson AFB

Source   GSA   LOCAL VENDOR   BASE SUPPLY   CONTRACTOR

Interface   COPIER CONTRACT   INDIVIDUAL OFFICES   DPSDO

Use   29 Copiers (Copier Manager)   570 Copiers (Individual Offices)   Printers   Letterhead   Documents   Forms
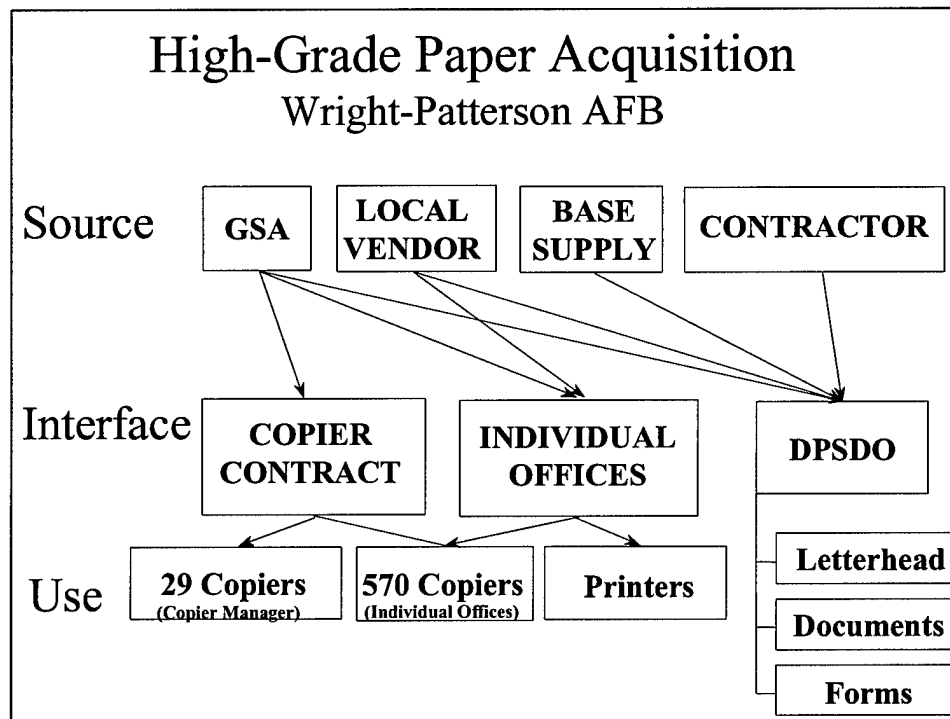
Figure 3. Wright-Patterson Air Force Base Paper Acquisition

Paper for the 29 HQ AFMC copiers is ordered directly by the copier manager. Purchasing from GSA by the copier manager or individual offices avoids possible legal violations by those who my not be aware of statutory requirements concerning post-consumer paper content (Balk, 1996).

Some of the key national, Air Force, AFMC, and WPAFB directives which currently apply to the procurement and use of paper at WPAFB are shown in Figure 4. These directives and their implications will be discussed in Chapter IV.

Regulatory Requirements/Directives

- Resource Conservation & Recovery Act, Section 6002
- Presidential Executive Order 13101, 14 Sep 98, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition
- 40 CFR part 250, Guideline for Federal Procurement of Paper and Paper Products Containing Recovered Materials
- Air Force Instruction 32-7080, Pollution Prevention Program
- Air Force Instruction 37-162, Managing the Processes of Printing, Duplicating, and Copying
- AFMC/CE Letter, 4 Nov 94, AFMC Qualified Recycling Program (QRP)
- Wright-Patterson AFB Qualified Recycling Plan

Figure 4. Directives Concerning Paper Acquisition and Use

According to Mr. Balk, one reason for using a centralized system of copier leasing and paper purchasing in AFMC headquarters is to prevent individual offices from developing an "I own it" attitude toward their copier and its paper supply. Copier malfunctions are relatively frequent and it is useful for the organization as a whole if the personnel from one office can use the copier from another office as needed without dealing with locked paper cabinets, or the need to obtain permission for copier use, or to replace the paper used. Each office

has a copier monitor who orders the required amount of paper from the copier manager each month. HQ AFMC uses about 200 cartons of copier paper monthly, each carton containing ten 500-sheet reams of paper. This is about one million sheets of paper per month and is in addition to the paper that is used for printers throughout the building. Paper used for the other copiers on the base contract is ordered individually by the separate offices and therefore cannot be accurately determined, however, in 1995 the machine copy count was 107 million copies (about 369 tons) made (Balk, 1996).

The price per ream may vary considerably over time, from about $25 to $45, making it difficult to predict the amount of paper that can be purchased during the year with a given budget. However if a shortage does occur, additional funds can be requested.

Printer Paper. Like copier paper, individual offices can order printer paper directly from GSA or from local vendors. As with copier paper, printer paper is ordered by telephone using an IMPAC credit card and is delivered directly to the work area (Balk, 1996).

Reproduction. The following information was provided by Mr. John Bigl (Bigl, 1996) of the Defense Printing Service Detachment Office (DPSDO) at WPAFB. The DPSDO procures paper in large amounts in order to print large-volume orders requested by various base organizations. These are usually multiple copies of documents that are too large to efficiently print on office copy machines, or items that require special printing capability. DPSDO also prints forms that are not available electronically, letterhead paper, and other

miscellaneous documents. DPSDO has the option of purchasing paper through Base Supply, local vendors, contractors, or GSA. Almost all purchasing is actually done through GSA, but when backlogs occur they may occasionally order letterhead paper from a contractor. Many offices are now using computer generated letterhead paper so the need to print or procure letterhead paper is dropping rapidly.

DPSDO does the actual printing for about 25 percent of customer requirements; about 75 percent is performed by the Government Printing Office (GPO). DPSDO prints the smaller orders and those that are of a non-routine variety such as retirement brochures or announcements. The large, mass-production work orders are sent to the GPO. At WPAFB, the DPSDO portion of the work requires approximately 40 million sheets of letter paper annually, with GPO work accounting for about 120 million more sheets, a total of about 160 million sheets for customers of the WPAFB DPSDO unit. That is, over 550 tons of paper annually.

The DPSDO units were previously operated by the U.S. Navy Supply Command, but were placed under the Defense Logistics Agency (DLA) on 1 October 96. Although DPSDO's final product is printed paper, DPSDO itself is rapidly moving toward becoming a paperless office. For example, the Wright-Patterson unit has only three of its original 30 older offset type presses remaining. The rest have been replaced by computer-operated printers which are basically large-sized versions of office copiers and printers. Printing material is fed in by optical readers, computer disk. or e-mail. Even customer requests

are now being taken electronically, including the billing. Job tickets are also automatically printed by the computer. Most elements of a particular job (number of copies, holes or no holes, or type of binding) are routine and can be automatically computed and charged to a customer's account which has been previously set up. When a customer's account gets low, or a particular order costs more than the customer's balance, the customer is automatically notified. Human intervention is needed only for special jobs or for orders that go to the GPO. The GPO makes its own cost estimates and these often vary widely from the actual bill charged to the customer. For those customers who appear in person at DPSDO with hard copies to be duplicated, DPSDO now has a credit card reader so that customers can charge costs to their IMPAC account.

Another area where DPSDO is assisting in the move toward paperless systems is in technical orders, specifications, and standards. DPSDO is in the process of saving hundreds of these documents onto CDs which will then replace the current hard copies. Once complete, this will allow instant access in the field to the entire Air Force library by any worker with a notebook computer plugged into the Internet, including workers on an aircraft being repaired. As with other paperless office innovations, the benefits are significant once the program has been implemented in its entirety, but getting there initially requires a great deal of effort. Reading in thousands of pages into computers with optical readers is a long and arduous task. Many errors are made by the optical readers and it is necessary to have human quality checks continuously throughout the process. DPSDO refers to themselves as being on the "bleeding edge" of technology

because of the difficulty level and the effort necessary for completion of this digitization program.

DPSDO operates similarly to a commercial business establishment, i.e., income is expected to meet or exceed costs. This includes deprecation of equipment, overhead, and all the other usual costs of operating a business. These costs are then used to determine the individual pricing for each type of DPSDO service that a customer might request. To stay at the forefront of technology, DPSDO continually purchases new equipment to replace older systems even though they may still be functional. Even though DPSDO has a wide variety of specialized equipment not used by the typical Air Force office, some of the initial problems experienced by DPSDO have application to many organizations working toward a paperless office.

One need that quickly arises is for high-tech, large-screen computers. DPSDO is currently switching to high-speed computers with 21-inch monitors. Slower computers with smaller screens are an impediment to paperless office operations. When trying to do as much work as possible electronically, acceptance of the change by the workers as well as actual worker output benefits greatly when fast, large-screen computers are available.

A second problem is the need for adequate training. The ability of advanced equipment to live up to its potential is strictly limited by the capability of the operators. Current computer training capacity at WPAFB, for example, has never been sufficient to keep up with even the normal needs of base organizations. Going to a system which is even more dependent on highly

trained employees will require a significant expansion in training capability. DPSDO has had to obtain off-base training for its employees, but it is unique in its ability to do so since it can just charge the cost of this training back to its customers as a civilian business would.

A third major requirement when implementing increased computer operations is to have increased computer support personnel available. Setting up and maintaining these systems requires a significant number of skilled personnel. At the present time, work delays are often experienced by employees while waiting for computer specialists to attend to their particular computer problem.

Unit Self-Purchase and Payment. Prior to 1996, office supplies were purchased by individual offices at base-operated local purchase stores utilizing revolving accounts. Each office or organization had an account in accordance with their budget, and an authorized individual could go to those stores and pick up supplies for their organizations. At large bases there might be two or more stores on base. In 1996, the Air Force switched to a new system whereby offices would order their needed supplies directly from GSA using the IMPAC credit card. This new system eliminates the need for supply personnel to man local purchase stores and thus aids in meeting Air Force downsizing objectives. However, it currently has the disadvantage that an organization cannot readily and reliably determine how much of a particular stock number item it has purchased during a particular period of time. Financial data is available from the system, but the system was not designed in a way that would provide information

concerning products ordered, stock numbers, submitting organization, and other purchase data.

There are two alternatives for implementing the new system as far as paper ordering is concerned (Balk, 1966): each office can (1) order their own, or (2) use centralized ordering. At WPAFB, HQ AFMC centralized paper ordering for its copy machine paper. This method has several advantages over individualized purchasing:

1. Potential monetary savings. Market prices for paper vary erratically over a period of time. Broad price fluctuations provide the opportunity for significant savings for those organizations that have the storage capacity to buy large amounts when the prices are lower. HQ AFMC has done so and has been able to cut its copy paper costs by 25 percent or more compared to buying on a random basis as need occurs. Storing and issuing paper through a central manager system has costs associated with it such as storage space and the wages of required personnel; however, the wide variations in paper prices would seem to make this process economically beneficial (Balk, 1996).

2. Versatility. Since all paper purchased under a single contract are obtained under a single fund cite, it is possible to readily increase or decrease amounts for individual offices as required without those offices going through the process of changing their official budget requirements. Under the centralized ordering system, each office has a tentative dollar amount assigned for planning purposes, but the individual controlling the centralized paper issue can instantly increase or decrease that amount as needed (Balk, 1966).

3. Procurement data. At present, with most offices ordering their own copy paper and printer paper directly from GSA, it is extremely difficult to determine how much paper is actually purchased by a particular base. The amount recycled is accurately known, but the amount purchased is not known with any degree of accuracy (Balk, 1966).

Recycling.

Although source reduction is the preferred method of reducing the volume of waste sent to landfills, even the most imaginative programs may not be able to totally eliminate paper or any other particular material. For example, a certain amount of paper may be needed for correspondence with outside agencies that require hard copies with original signatures. Also, a totally or near totally paperless office will not occur immediately, but will take many years to implement. This leads to the second priority in the hierarchy of waste reduction, recycling.

Rationale for Recycling. A review of the recycling literature produced by individuals or organizations which support conducting or participating in recycling programs finds that a number of reasons for recycling of high-grade paper are frequently cited:

1. Cost avoidance. Supporters state that there is a significant cost to an organization for burning or burying waste materials, and these costs have increased almost every year since 1985 as shown in Figure 5. Average tipping

fees per ton (cost charged by landfill operators) rose from about $8 in 1985 to

about $32 by 1995, an increase of 300 percent in just ten years.

National Average Tipping Fees in the U.S.
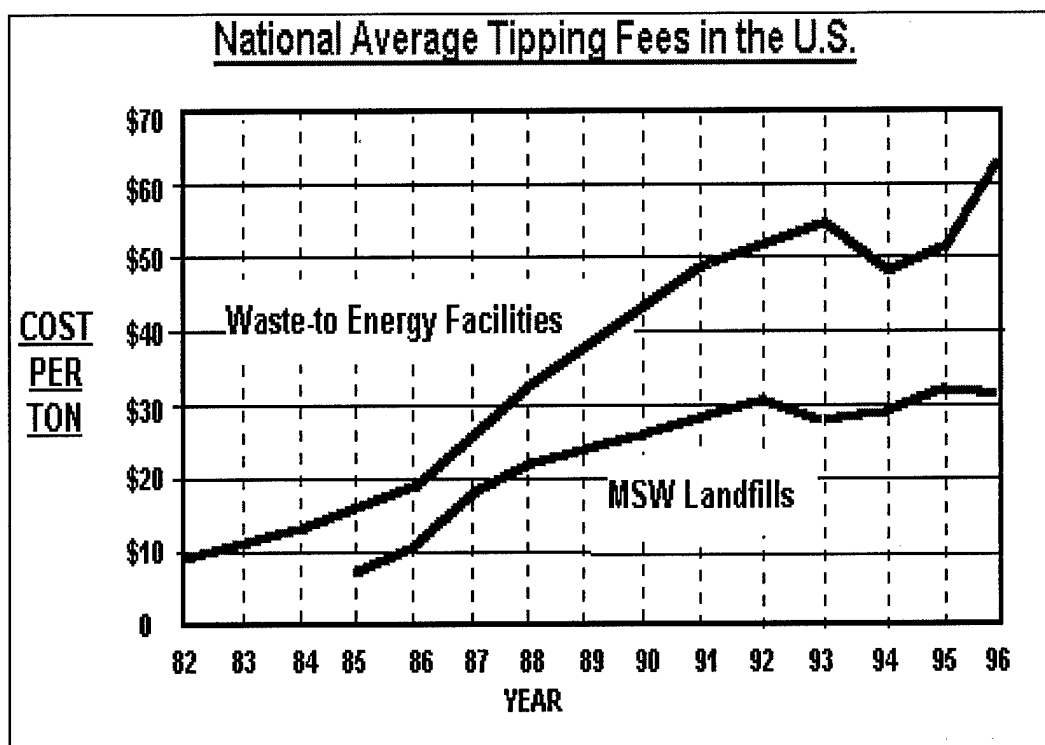
Figure 5. Disposal Cost Trends (EPA Factbook, 1997)

According to Denison and Ruston (Denison, 1997:55), landfill space tends

to be highest where the population is most dense—in the Northeast and the West

Coast where two-thirds of the nation's curbside recycling programs operate.

They say that more stringent environmental regulations have caused many local

landfills to close thereby forcing communities to use distant landfills. In some

cases, the disposal cost per ton increased as much as 400 percent in a single

year.

2. Income. In his article, "The Truth About Recycling Costs,"which

appeared in the 10 December 1996 issue of Recycling Times, (Watson, 1996:15)

Stuart Watson, project coordinator for the Urban Corps of San Diego, expressed

strong disagreement with those who question the economics of recycling. He

said that 73 percent of recycling, by tonnage, consists of commercial products

and products collected through drop-off and buy-back centers which almost

always operate at a profit, and that anti-recycling articles are implicitly directed at

residential curbside recycling only. He stated that criticism of curbside recycling

is based on misinterpretation of data because those critical economic studies

invariably exclude the cost of landfill disposal. He says the only accurate way to

determine the fiscal impacts of a municipal recycling program is to compare the

cost of the entire solid waste system with the recycling program to the projected

cost of the solid waste program system without the recycling program. He further

stated that the profitability of a curbside program is capital intensive thus is highly

volume dependent. Increasing volume decreases per-unit cost. He reported that

one study found that increasing recycling rates to more than 10 percent of total

waste generated reduces recycling collection costs by 64 percent.

   3. Landfill limitations. Space for landfills in most states is a serious

problem as is the political decision of where to place landfills. To be economical,

landfills must be situated near areas where people live, but people are generally

opposed to the idea of living near a landfill. In 1978, there were 20,000 landfills

in the U.S. In 1988 there were 8,000. By 1996 that number had been reduced

to 3,091 (EPA, 1998). It is predicted that this will drop to less than 1,300 by

2008 (ReThink,1996).

YEARS OF REMAINING LANDFILL CAPACITY

Legend:
- <5 years
- 5-10 years
- > 10 years
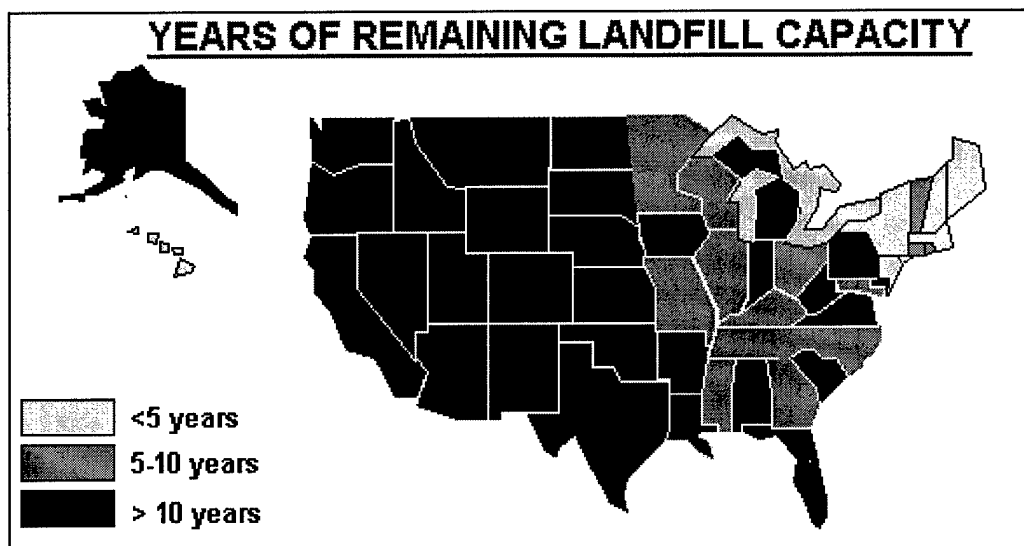
Figure 6. Landfill Sites are Becoming More Difficult to Find

(EPA Factbook, 1998)

4. Energy savings. The EPA believes that national energy resources can be conserved by recycling (EPA, 1998). Aluminum cans, for example, can be produced from recycled cans with only 5 percent of the energy required for cans made of virgin aluminum. The Director of ReThink Paper, Emily Miggins (ReThink, 1996), reports that every ton of recycled paper used instead of virgin paper saves 4,100 kilowatt hours of energy.

5. Conservation of limited resources. Aluminum, coal, oil, and gas are limited resources. Trees are replaceable, but only at a certain rate and thus are also a limited resource above and beyond that rate. More importantly, according to Denison and Ruston (Denison, 1997), tree farms are not an ecological replacement for natural forests that provide animal habitat and preserve biodiversity. Miggins (ReThink, 1996) states that loss of habitat is the number one cause of species extinction

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6. Pollution prevention. Supporters of recycling claim that products made from recycled materials can often be produced with significantly reduced potential pollution and hazardous waste. The ReThink Paper environmental organization (ReThink, 1996) says that paper produced by recycling produces 74 percent less air pollution and 35 percent less water pollution than paper produced from virgin materials.

7. Social responsibility. Denison and Ruston (Denison, 1997) state that recycling enjoys strong support among the public because people believe that recycling is good for the environment and conserves resources. Further, they feel that recycling should not be expected to pay for itself—it is simply a cost that society must bear because of its benefits to society and the environment.

8. Public opinion. Avoiding a negative image with the public and in the media may be a strong motivator in establishing active recycling programs by organizations such as the Air Force.

9. Legal requirements. Federal or state authorities may issue directives mandating recycling programs. For example, the Resource Conservation and Recovery Act (RCRA) and Executive Order 13101 require federal agencies such as the Air Force to purchase paper products containing at least 30 percent recycled material unless a valid exception allows otherwise.

10. Job creation. According to the staff of ReThink Paper (ReThink, 1996), recycling may not only pay for itself, it may create many more income-producing jobs than do land disposal processes. They report that In one

study of the metropolitan areas of Washington, D.C., Baltimore, Maryland, and Richmond, Virginia, it was found that the recycling sector supported 7,187 jobs versus 1,418 jobs for the disposal sector even though only 24 percent of the waste stream was recycled compared to 74 percent of the waste stream going to landfills and incinerators. As noted above, Stuart Watson (Watson, 1996) maintains that proper accounting demonstrates that recycling programs do operate at a profit. If this is true, one significant benefit of recycling would then be that it provides far higher employment opportunities than traditional land disposal at a cost to municipalities that is about the same or even less than land disposal.

National Recycling Progress. National MSW generation has risen from less than 90 million tons annually in 1960 to well over 200 million tons currently. Daily per capita generation has risen from 2.7 pounds to almost 4.5 pounds in the same period of time (EPA, 1998). Despite this rapid increase in the generation of MSW, Figure 7 shows that deposits to landfills has been on a downward trend in the last 10 years due to a significant increase in recycling and composting. Increased tipping costs for landfill disposal and for combustion disposal have stimulated this trend by increasing the cost of these forms of disposal. The reduced number of locally available landfills has also increased the transportation cost of landfill disposal thereby providing additional economic incentive for recycling programs.

TRENDS IN WASTE GENERATION , RECOVERY & DISPOSAL
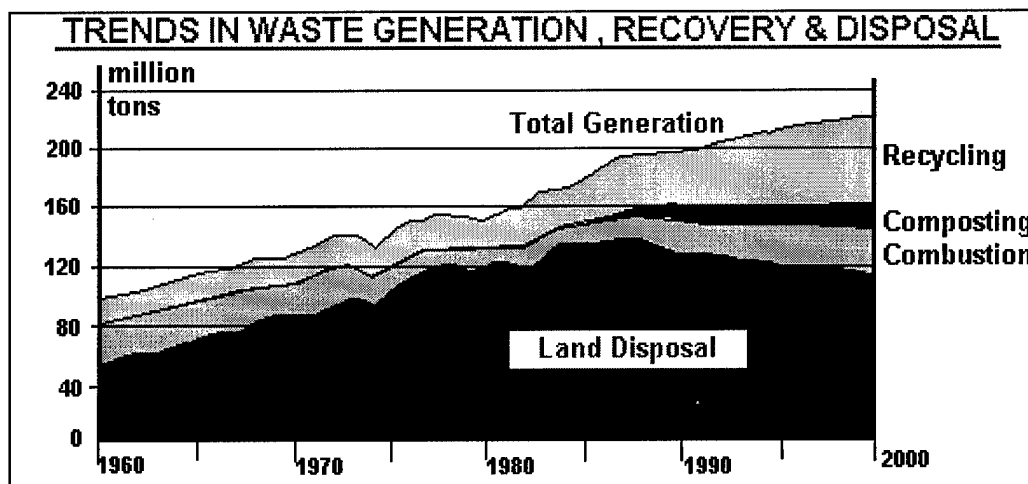
Figure 7. Greater Recycling Partially Offsets Greater Generation

(EPA Factbook, 1998)

National Materials Recycling
1993 versus 1988
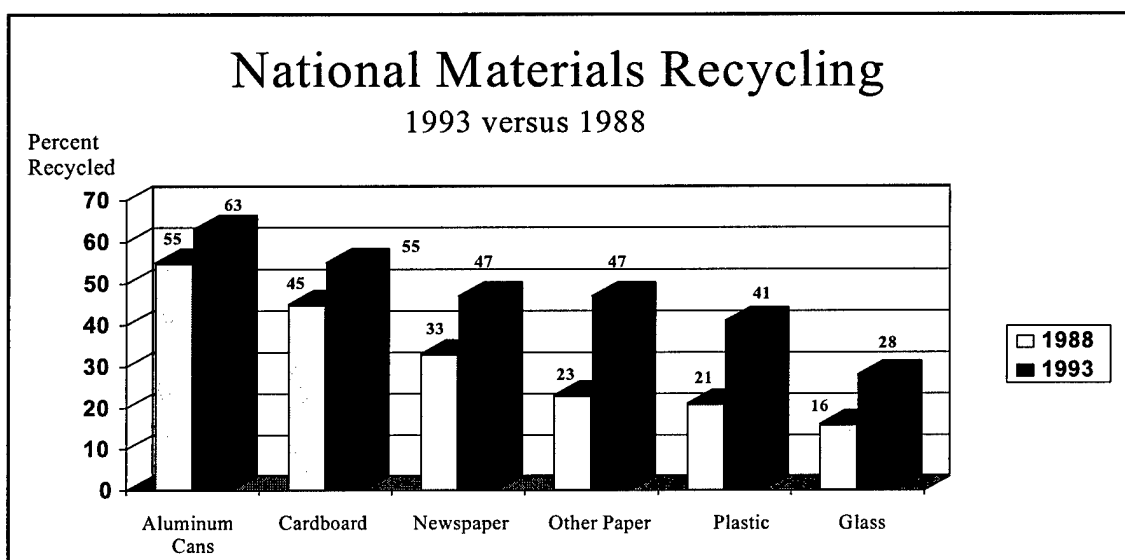
Figure 8.   Trends in US Recycling (After EPA Factbook, 1996)

Figure 8 shows that In the five-year period from 1988 to 1993, recycling of all major types of material increased significantly, some by as much as 100 percent. Despite continued progress in recycling, Figure 9 shows that MSW currently going to landfills in the U.S. still consists mostly of material that could be

recycled, including 32.2 percent paper products, with high-grade office paper still

having a large recycling potential as shown in Figure 10.

NET WASTE DISCARDS

GLASS	6.4%
METAL	6.4%
FOOD WASTE	8.9%
PLASTIC	11.8%
YARD WASTE	13.7%
OTHER	20.6%
PAPER & PAPERBOARD	32.2%
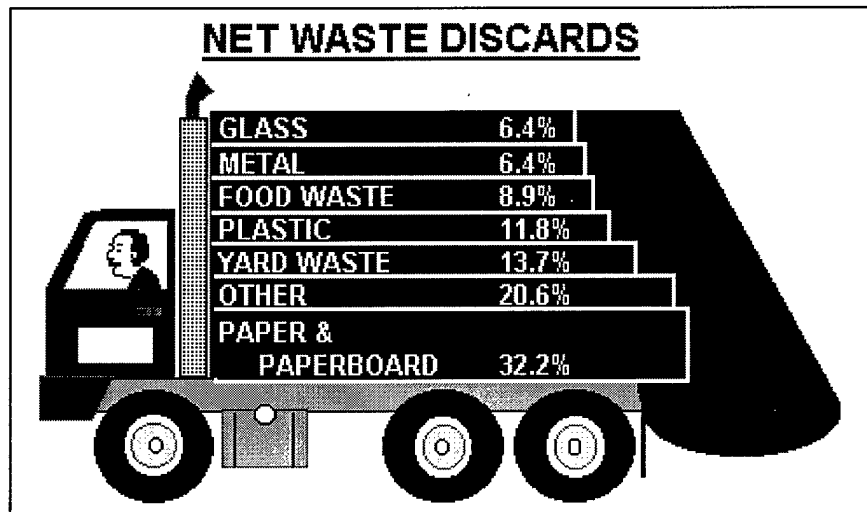
Figure 9.   Waste Disposal after Recycling (EPA Factbook, 1998)

Federal Office Building Waste Stream Composition
(Prior to Recycling)

Other Paper 7.4%
News 7.0%
Plastic 2.6%
Glass- 11.8%
Food 2.9%
Cardboard 2.8%
Other- 3.9%
Metal 1.8%
LG Grade Paper-20.2%
HG Paper- 39.6%

Total Generation = 2.9 lbs/employee/day
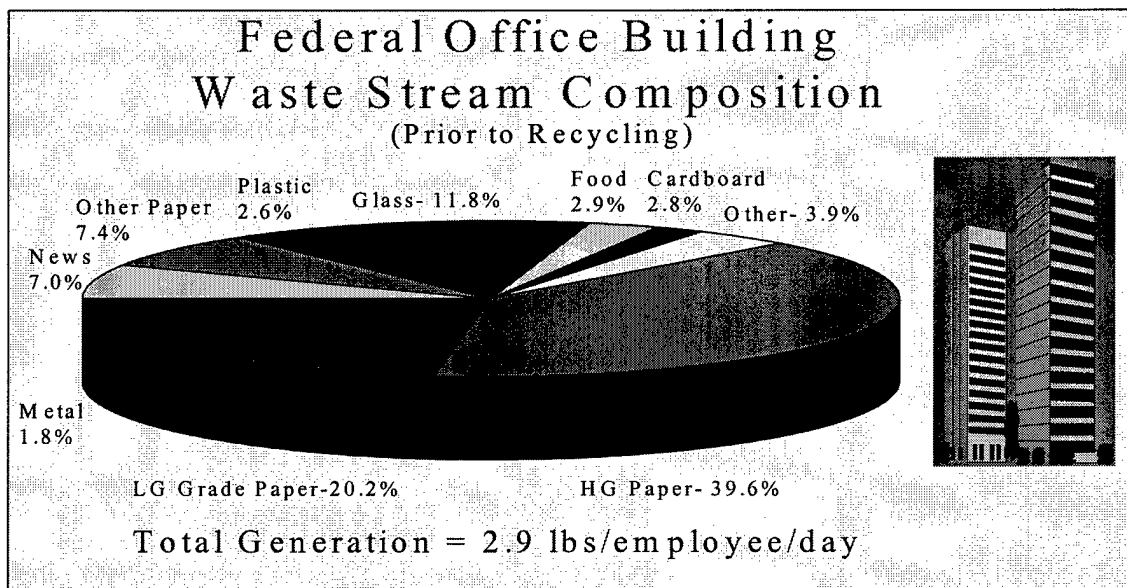
Figure 10.   Federal Office Building Waste Container Contents

(EPA Factbook, 1998)

Figure 11 shows that composition of waste for the various industrialized nations is similar in material content, but there are significant variations in the percents of those materials within a nation's MSW. In the U.S. almost 40 percent of waste material is paper.
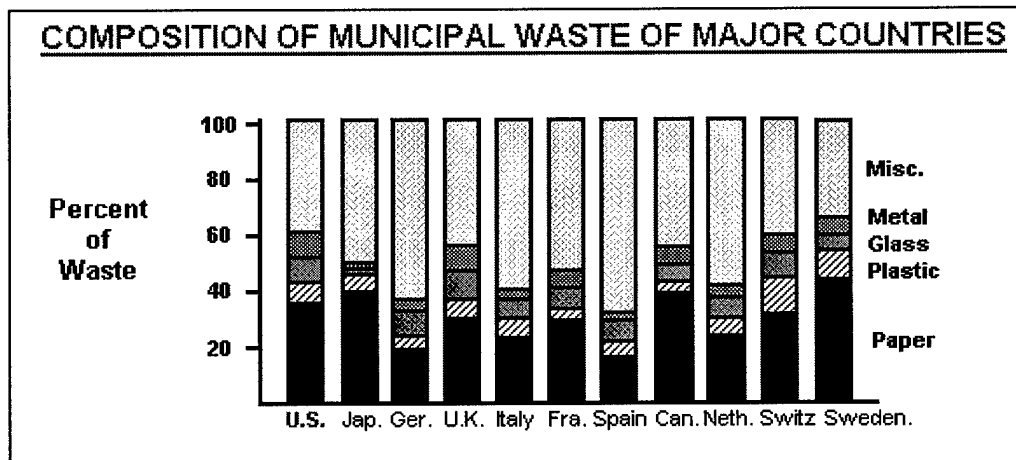
Figure 11. Solid Waste Materials Vary by Country

(EPA Factbook, 1998)

Economics of Recycling. William Ruckelshaus explains in his article, Toward a Sustainable World (Ruckelshaus, 1989:166-174), stated that the environmental cost of producing a good or service is not accounted for in the cost of obtaining it. That in willful ignorance, and in violation of the core principle of capitalism, nations refuse to treat environmental resources as capital. Nations spend those resources as income and then are as puzzled when there is eventually a price to pay. Such "commons" as the atmosphere, the seas, fisheries, and goods in public ownership are vulnerable to being overspent in this way, treated as either inexhaustible resources or bottomless sinks. He says the

reason is that the benefit to each user is gained exclusively by that user and in the short term it is a gain. The environmental effects are spread out among all users and are apparent only in the long term, when the resource shows signs of severe stress or collapse. He believes the way to avoid this eventuality is to make people pay the full cost of a resource use--to close the loops in economic systems. Ruckleshaus says that the general failure to do this in the industrialized world is related to a second problem, the problem of action in a democracy. Modifying the market to reflect environmental costs is a function of government. Those adversely affected by such modifications, although they may be a tiny minority of the population, often have disproportionate influence on public policy. In general, the much-injured minority proves to be a more formidable lobbyist than the slightly benefited majority

Jim MacNeill (MacNeil, 1989:155-165), secretary general of the World Commission on Environment and Development in 1989, supports the concept of assessing environmental costs. MacNeill says that public policies often unintentionally encourage deforestation, destruction of habitat and its species, and decline of air and water quality. Government budgets which subsidize environmentally destructive practices are often enormous compared to that which is set aside for environmental protection. For example, Brazilian taxpayers underwrite the destruction of the Amazon forests and American taxpayers underwrite the destruction of the Tongass, the rain forest of Alaska. Existing incentives in the world trade of forest products encourage the overharvesting of forests. MacNeill says if these policies and incentives remain

in place, most of the world's remaining forests will probably be destroyed, with all that implies for food security, desertification, flooding, and global warming. He says that energy subsidies also promote the opposite of what is necessary for sustainment into the future. They ignore the costs of depleting resources and of sullying air, land, and water, they favor waste and inefficiency and they underwrite traditional sources of power--coal, oil, and nuclear--rather than renewables. In doing so they impose enormous burdens on already tight budgets and on scarce reserves of foreign currency. Like Ruckleshaus, MacNeill believes that the solution is the merging of environmental considerations with economic decisions to create market incentives. This would involve the elimination of current environmentally counterproductive incentive systems and replacing them with programs which internalize environmental costs so that the environmental costs of development are reflected in the prices consumers pay for goods. Concerning the question of whether economics can be restructured to support sustainability of the environment, MacNeill says that it is not an academic question, but is a question of survival (MacNeill, 1989:157).

The same points made by Ruckleshaus and MacNeill were again emphasized in a report by the Japanese Institute of Fiscal and Monetary Policy, Ministry of Finance (JIFMP, 1996). They stated that from the standpoint of economics, environmental problems are rooted in the existence of economic externalities and that, up to now, the environment has been treated as a free resource. The costs required for environmental conservation have not been

included in the costs and prices of economic transactions. That is, the cost of depleting the environment has not been recognized as a factor in economic decisions. They suggest that one solution to environmental problems is to incorporate environmental conservation into economic calculations. A socioeconomic system that places a minimal load on the environment will be one in which individuals and corporations bear the costs of environmental conservation in the process of their decision-making, ensuring appropriate environmental considerations as a result. There are various types of economic methods that might be used, including taxes, charges, user fees, tradable emission permits systems, subsidies, and deposit-refund systems. Each of these has its own pluses and minuses, and they should all be compared and considered from different perspectives--including their effectiveness, economic efficiency, fairness, feasibility, and social acceptance--and be applied in appropriate combinations. Nations must work toward the integration of the economy with the environment through the best possible combinations of all these economic measures--and, where appropriate, must implement direct regulations. The report states that the maximization of the flow of resources and materials—something that modern civilization has relentlessly pursued—is only possible in an open system that has an available supply of outside resources. Current conditions have forced recognition that the earth is a closed system. Within this closed system, our goal should be to maintain a set level of assets, or economic stock, and to derive a high level of social welfare from these assets, while at the same time minimizing production, consumption and, waste.

Herbert Lund provides a detailed analysis of recycling economics under

the topic of market development in The McGraw-Hill Recycling Handbook (Lund,

1993:7.13-7). He states that there are a variety of ways to improve the

economics of recycling, broadly fitting into two categories--economic intervention

and free market promotion. Economic intervention includes loans and loan-

guarantee programs, grants, subsidies, tax incentives, and recycled-content

credits. Free market promotion refers to removal of virgin market subsidies

(federal depletion allowances, forest service policies, and the accelerated timing

of deductions), disposal pricing (pricing disposal costs to include expenses of

facility closure, long-term monitoring and remediation, and development of new,

more expensive facilities), and external cost accounting (assessing

environmental costs to virgin materials).

In his article, "The Truth About Recycling Costs" (Watson, 1996),

discussed hidden benefits of recycling that are not generally considered

when evaluating the economics of a recycling program. These include the

costs and environmental impacts of the waste streams on air, water, and

land resources. He said that extracting and processing natural resources is

very energy intensive and that the impact of recycling on jobs is another

positive factor that is often not considered. He reports that one study found

that 15,000 tons of solid waste equates to an average of one job if landfilled,

two jobs if incinerated, seven jobs if composted, and nine jobs if recycled. .

Watson ends his article with a statement closely akin to those of

Ruckleshaus, MacNeill and the JIFMP, "Recycling is not an 'environmental hobby'—it is an economic imperative".

Figure 11 is a poster prepared by the Institute for Local Self Reliance (ILSR, 1997) supporting Watson's contentions and which illustrates the possibility for economic growth in Baltimore, Washington, DC, and Richmond, Virginia during the next decade if recycling is maximized. It is intended to graphically portray the potential to increase employment and business activity through recycling and to influence public opinion in favor of increased recycling
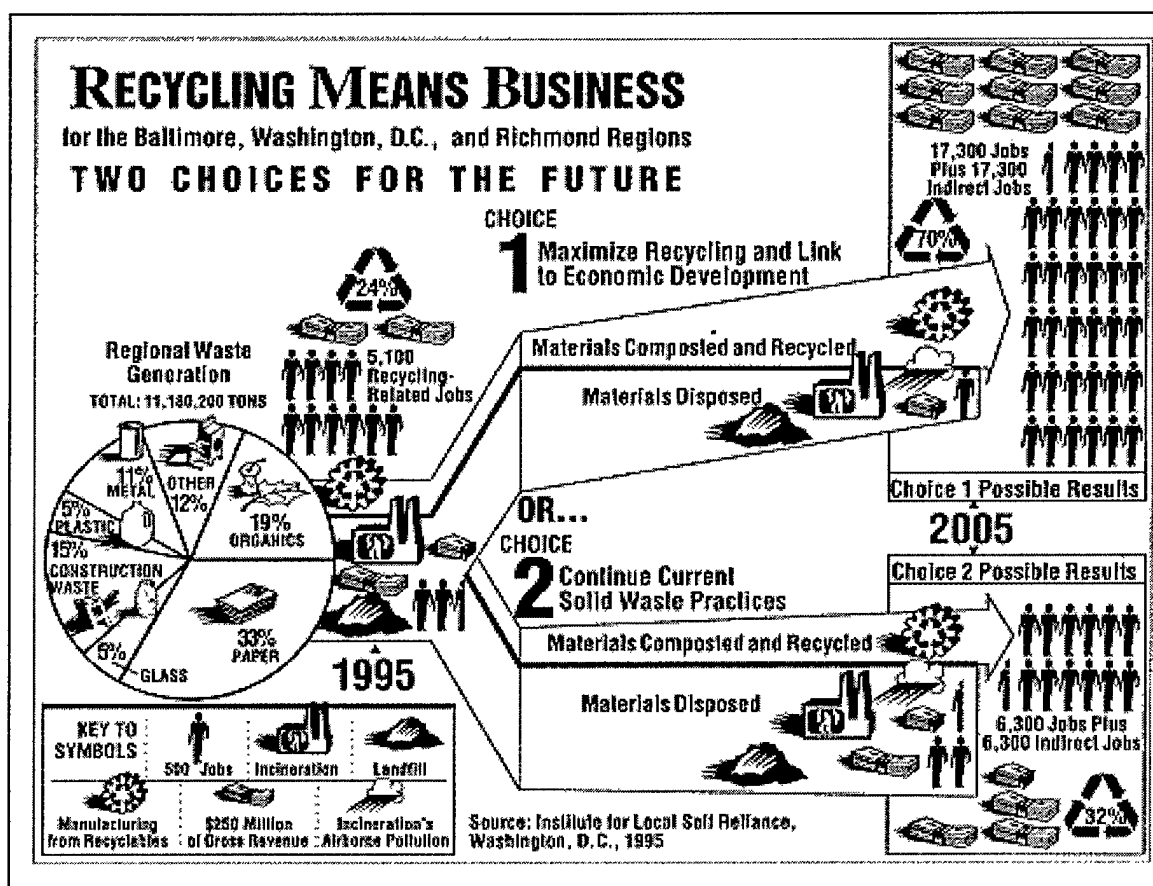
Figure11.   Poster Illustrating Economic Benefits of Recycling

(Institute for Local Self Reliance, 1997. Used with Permission)

Two key points made in the above discussions are:

1. Preservation and conservation of the earth's resources through recycling and other processes is necessary for the long-term benefit of mankind.

2. An important method for ensuring the achievement of this goal is the use of economics--ensuring that true costs to the environment are reflected in the marketplace.

Summary

The hierarchy of preferred options for reducing waste begins with prevention and reduction (source reduction), followed in order by recycling and reuse, treatment, and then as a last resort, disposal.

Source reduction as concerns high-grade paper can be implemented in a variety of ways including double-sided copying and printing; electronic transmission and storage of documents; reusing scrap paper; selecting appropriate type size, font, and margins; training personnel concerning paper-saving capabilities of their office equipment; using electronic forms; using convenient recycling receptacles; and changing certain office procedures such as methods of faxing, editing, coordinating, distributing, and filing.

Air Force organizations may purchase high-grade paper locally or from the GSA by use of IMPAC credit cards. In either case, data is not available from the GSA or Air Force supply sources concerning the annual volume of those

purchases because the IMPAC credit card system was not established in such a way as to provide that type of in formation to users of the system.

Recycling is the second preference in the waste reduction hierarchy. Supporters of recycling suggest that there are a number of valid reasons for establishing recycling programs such as avoiding landfill fees, benefiting financially from the recycling program itself, landfill space limitations, energy conservation, resource conservation, pollution prevention, social responsibility, public opinion, legal requirements, and job creation.

Despite significant recycling progress in recent years, large amounts of recyclable materials are still being sent to landfills within the U.S. A major item of waste is paper products. Almost forty percent of waste materials being sent to landfills are composed of paper products of some type. Current figures also show that paper products account for about sixty percent of office waste, with about forty percent of that being high-grade paper.

Several authorities have stated that well-managed recycling programs are viable economically as well as being necessary for the future well-being of our economy. They maintain that our current problem of not always operating recycling programs at a profit is due mainly to the fact that users of virgin materials are not paying a fair price for their use of the nation's natural resources. This, in turn, prevents recycled materials from achieving the naturally competitive advantage that should occur as the result of having already passed through a major portion of the production process. The authorities cited in this chapter recommend that some form of government imposed cost

differential be placed upon the use of virgin materials so that recycled materials

can compete more effectively in the marketplace.

III. Methodology

The objective of this research was to gather information concerning high-grade paper recycling program management within the Air Force and the Air Force Materiel Command (AFMC), what means are available for reducing the need for high-grade paper, what data concerning the recycling of high-grade paper is currently being gathered, what data should be gathered and by what means, and to determine which recognized best management practices could be implemented to improve program performance. As noted previously, paper production uses large amounts of tree products, requires the expenditure of a great deal of energy, creates large amounts of air and water pollution, and, if not recycled, occupies a large volume of valuable landfill capacity.

This chapter outlines the methods used to gather information and answer the research questions, defines the population, discusses the collection process for information gathering and the sources of that information, and describes the analysis process.

Population

The topic of this study is the high-grade paper-recycling program of AFMC, all of whose bases are located in the forty-eight contiguous states. However, to properly assess the AFMC program, it was also necessary to gather information from other commands with bases in the continental U.S. as well as information from the Air Staff.

Although this is an AFMC study, the AFMC program operates within the same Department of Defense (DoD) and Air Force guidelines as do other commands within the U.S., thus in most cases conclusions and recommendations apply equally as well to other Air Force commands located in the U.S. and to the portions of the Air Force recycling program applicable to these commands. Non-continental U.S. commands were not included in this study because conditions under which their recycling programs operate in other nations may vary considerably from that of the U.S., especially as concerns local regulations and markets for recyclable materials. Conclusions and recommendations of this study may no be appropriate for those commands.

Specific organizations contacted for information other than AFMC were the Air Combat Command, the Air Education and Training Command, the Air Force Space Command, the Air Force Special Operations Command, the Air Mobility Command, the Air Force Reserve, and Headquarters U.S. Air Force Environmental Division (HQ USAF/ILEV). The key purpose in contacting other continental commands was to determine if one or more of those commands had developed a method for determining the volume of their annual high-grade paper purchases. HQ USAF/ILEV was contacted in order to obtain information concerning Air Staff recycling metrics and Air Staff recycling program philosophy. This included information concerning which data is collected by the Air Staff, who is briefed and what material they are briefed on, intent of Air Force recycling policies, plans for future changes to the program, and other similar subjects.

Information concerning the AFMC recycling program was obtained from the HQ AFMC Civil Engineering Pollution Prevention branch (HQ AFMC/CEVV). Information concerning high-grade paper acquisition was obtained from the HQ AFMC Communications and Information Directorate (HQ AFMC/SC) and the WPAFB Defense Printing Service Detachment Office (DPSDO). Information concerning the conduct of base-level recycling operations was obtained from the 88th Air Base Wing Waste Management Branch (88th ABW/EMC).

Preliminary Question

Underlying this research effort is the assumption of principles reflected in the hierarchy of pollution prevention. Resource reduction, as was addressed in Chapter II, should always be attempted before resorting to the waste management practices of recycling, treatment and disposal. Possible means for reducing Air Force requirements were developed by reviewing a wide variety of internet sites concerned with the general topic of the "paperless office;" personal interviews with HQ AFMC/SC, DPSDO, and 88th ABW/EMC personnel; review of recommend ideas by the EPA, AFPA, BMP, Air Force Resource Recovery & Recycling Program Guide (AFRRRPG), EMA, NRDC, PNEB, ReThink Paper, Pro-Act; and personal experience and knowledge gained from more than thirty-six years of Air Force employment.

Despite current advancements and probable future progress in reducing the need for high-grade paper through use of electronic equipment, process changes, and other means, generation of large quantities of high-grade

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documents will likely remain inevitable into the foreseeable future, thus issues

addressed by this research merit organizational policy consideration.

In addition to the above, the topic of recycling economics was also

discussed in Chapter II because cost and profitability are major topics of concern

for those who manage such programs.

Analytical Approach

Research Question 1. The current AFMC paper recycling program's

methods of data collection and measurement are addressed in the first sections

of Chapter IV, Literature Review and Chapter V, Findings and Analysis. Data

concerning national, Air Force, AFMC, and WPAFB high-grade paper recycling

were obtained from the EPA, HQ USAF/ILEV, HQ AFMC/CEVV, and the 88th

ABW/EMC, respectively. Information concerning the appropriate metric for a

high-grade recycling program was obtained from the EPA, the AFRRRPG, and

various other high-grade paper recycling program literature. Several possible

means of collecting such data are suggested in this study; however, this is a

complex topic within itself and is thus recommend for additional research.

In Chapter V, the available data relevant to the AFMC high-grade paper

recycling are analyzed with regard to content, audience, value, perceived

deficiencies, data gathering difficulties, and proposed alternative metrics.

Research Question 2. The central focus of this study is the application of

best management practices to the AFMC high-grade paper recycling program..

Because literature review and findings/analysis are equally important elements of

methodology for this study, Chapter III was placed before literature review rather than after it as is customary. That is, as described below, the best management practices noted in Question Number 2 were derived by reviewing appropriate literature, thus the literature review is a key element of the methodology along with findings/analysis.

The intent of this portion of the study was first to determine if there are certain management activities or actions that are commonly put into place to ensure the success of management initiated programs or projects, and which can be discerned by reviewing literature dealing with program and project management. For the purposes of this study, these actions or activities are referred to as "program management elements." Individual references, including academic journal articles, management texts, guidance by the International Organization for Standardization (ISO), public law, Code of Federal Regulation (CFR), Executive Orders (E.O.), Department of Defense (DoD) Recycling Policy, Air Force Instructions (AFIs), various Air Force guidance documents, AFMC guidance documents, and several private organization publications, were reviewed for the presence of actions and activities which could be classified as program management elements. Pertinent sections of each reference were individually outlined and summarized. Next, those activities which were most prevalent, appeared to be the most significant as concerns program or project success, and which satisfied the definition of a program management element, were depicted in a chart showing which of those elements were associated with each individual reference.

Those proposed program management elements are then discussed individually with reference to their meaning, importance, and what constitutes a proper application of these elements.

Chapter V, Findings and Analysis, discusses each of the program management elements as they relate to the AFMC high-grade paper recycling program with emphasis on which elements are present or absent, and, if present, their adequacy based on the material presented in Chapter IV, and implications of these findings.

Chapter VI, Conclusions and Recommendations, provides recommendations addressing the findings noted in Chapter V.

IV. Literature Review

Introduction

This chapter is divided into two major sections. The first section provides statistical and graphical data depicting waste reduction progress by Air Force and AFMC. It is divided into four subsections: Air Force Data, Major Command Data, WPAFB Data, and Section Summary. The second section reviews a variety of reference materials that deal with activities that comply with this study's definition of program management elements. It is organized into four subsections: Key Reference Materials, Summary Table, Program Management Element, and Section Summary.

Recycling Data

National Data. Figure 12 depicts national paper recycling rates and is provided for reference purposes when reviewing Air Force and Major Command data. It shows that the material with which study is primarily concerned, high-grade paper, was recycled at a rate of 25.7 percent nationally in 1995.

Air Force Data. Figure 13 depicts Air force progress in meeting its original goal of a 50 percent reduction in Municipal Solid Waste (MSW) sent to landfill disposal or for incineration by CY97 compared to the baseline year CY92. The goal was easily met. The goal only concerned diversion of waste from
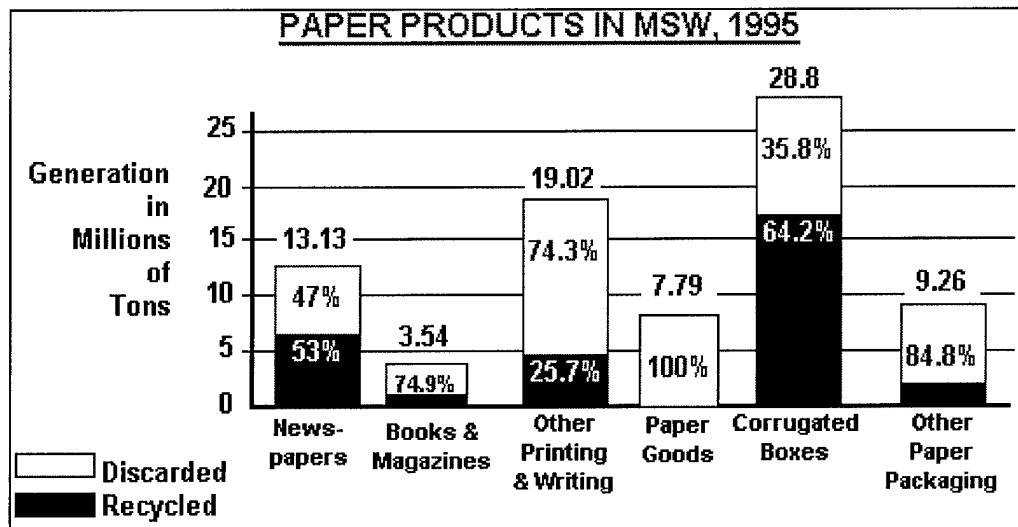
Figure 12.   Paper Products Discarded and Recycled Nationally in 1995

(EPA Factbook, 1998)

landfills and did not include a sub-goal for recycling; however, whatever material

that was recycled did contribute to reducing landfill disposal requirements. Good

progress toward the 50 percent goal was made between 1993 and 1997.

According to Major Mike Hass of the Air Staff Environmental Division (HQ

USAF/ILEV, 1996), this progress was aided by overall force reductions and base

closures taking place that were not accounted for in the data. This chart was the

only one briefed to the Air Staff illustrating progress in reducing waste. As noted,

it does not contain any specific information concerning recycling. The new Air

Force and Command goal does not refer to a baseline of any type, but instead

sets a moving target which begins with a goal of 15 percent diversion 1999 and

raises the goal each year thereafter until reaching a peak goal of 40 percent

diversion in the year 2000 and is titled the "New DoD Pollution Prevention

Measure of Merit (MoM)" (Pohlman, 1999).   One especially noteworthy item in

this document is that it directs organizations to pursue these goals only to the

extent that they can be "accomplished while achieving an economic benefit."

That is, program costs must be less than or equal to the equivalent cost of

landing filling or incineration.
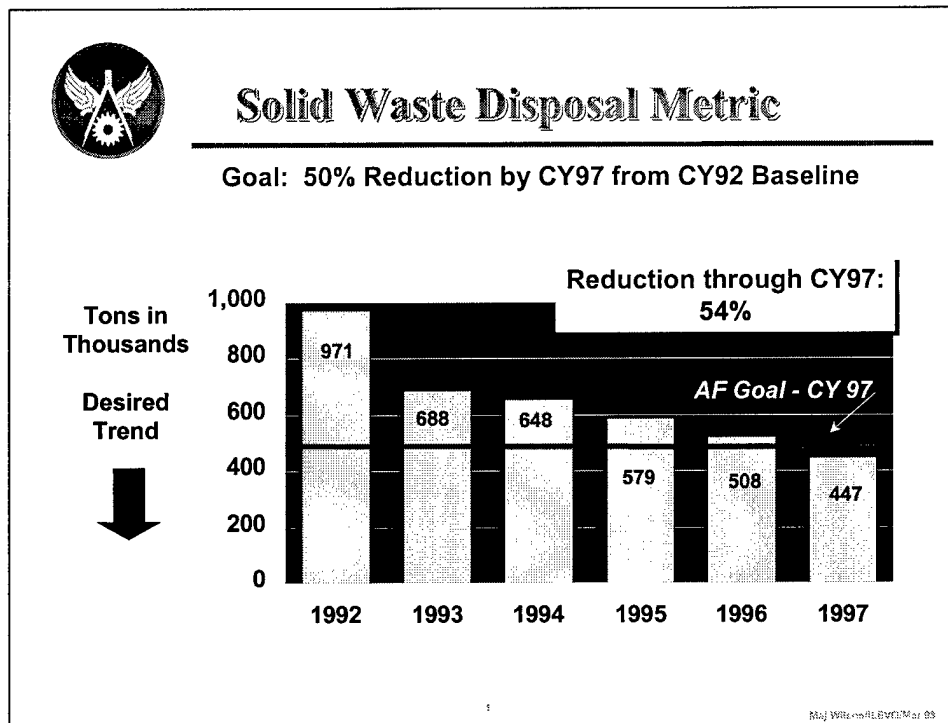
Figure 13. Air Force Waste Disposal Progress (HQ USAF/ILEVQ, 1998)

Table 1 depicts one additional metric maintained by the Air Staff

Environmental Division, but it portrays data only in terms of tons of material

recycled. Further, this information is not briefed to Air Staff upper management.

Table 1. Tons of Material Recycled by Air Force Commands,

Continental U.S. and Overseas (HQ USAF/ILEVQ, 1998)

	Solid Waste Recycled In Tons					
	CY 92	CY 93	CY 94	CY95	CY96	CY97
ACC	18,209	22,595	26,410	28,044	28,801	32,734
AETC	6,473	8,499	14,034	9,470	11,725	12,802
11 SW	741	970	1,002	1,375	1,960	2,100
AFMC		42,673	36,398	36,806	50,847	49,443
AFRC	108	1,648	1,738	816	1,350	1,479
AFSOC	321	535	576	668	795	1,391
AFSPC				5,976	4,585	20,686
AMC	6,206	5,403	6,900	8,620	10,848	14,443
ANG		2,846	10,079	12,100	6,858	1,647
PACAF				12,025	12,312	6,634
USAFA		282	286	343	300	1,436
USAFE	492	42	21,989	46,078	31,276	38,832
	32,150	**85,493**	**119,412**	**162,321**	**161,657**	**183,627**

Major Command Data. Waste reduction progress for AFMC parallels that

of Air Force as is shown by Figure 14. Each year from 1993 through 1997,

AFMC exceeded the annual waste reduction goal that had been established

using the baseline year of 1992. However, as with Air Force, the data only

reflects tons of material that was no longer being sent to landfills. Such data has

the advantage of being relatively easy and economical to obtain, but does not

provide any information concerning recycling rates for the particular materials

involved.
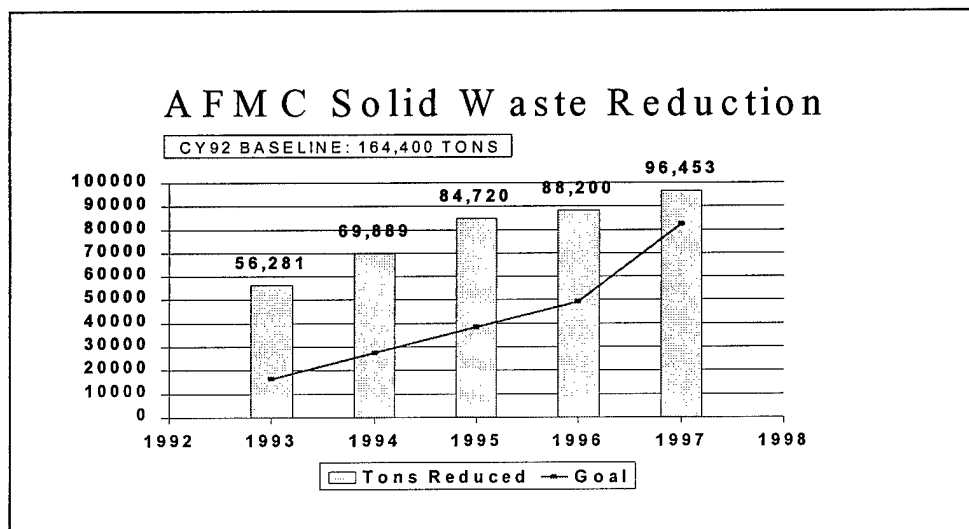
Figure 14. AFMC Solid Waste Reduction Progress (Annamraju, 1998)

Table 2 provides data concerning materials recycled by AFMC. The data only refers to tons of each material recycled, and does not provide information concerning the ratio of material recycled versus amount purchased

Table 2. Tons recycled by AFMC (Annamraju, 1998)

AFMC Materials Recycling Tons						
	1992	1993	1994	1995	1996	1997
Cardboard	8151	8042	8447	8471	9188	8239
HG Paper	5344	5176	4878	4343	3783	3658
Newspaper	965	1006	1115	1115	1179	2057
Scrap	10524	15477	10121	11718	12299	12059
Wood	2387	4056	5131	4479	3773	5471
Composting	113	2801	8501	7022	12874	10649
Other	7564	8916	6706	7751	7785	7300
Totals	35048	45474	44899	43848	50881	49433

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Recycling program managers at each of the continental commands other than AFMC were contacted to determine what high-grade paper recycling data was being gathered by their bases and by the command headquarters. In each case the reply was the same—data concerning amounts of high-grade paper being recycled was known, but percent recycled could not be calculated because they had no means of determining the amount of paper purchased. Only the mass of material being collected for recycling was being collected and reported

WPAFB Data. According to Mr. Bill Meinerding, 88th ABW Qualified Recycling Program Manager (88 ABW/EMC), the 1995 overall recycling rate for WPAFB was estimated to 20.6 percent. The rate for paper products and containers was estimated to be 11.8 percent. The rate for high-grade paper was estimated to be 10 percent. This rate compares to a national rate of 25.7 percent for the same year. The WPAFB recycling rate estimates were based on a 1993 contractor study whereby waste containers throughout the base were surveyed to determine content of recyclables (Annamraju, 1996). Since the amount of paper and other materials being recycled was known from recycling unit records, the two figures were added together under the assumption that the combined data would provide a reasonable estimate of total recyclable consumption by the base for each category of recyclables. This estimated total consumption, in turn, would allow calculation of an estimated recycling rate for high-grade paper and other recyclable materials. In the case of high-grade paper, the data was not corrected for differences between the amount of paper

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coming onto or going off the base through the mail system, nor was it corrected to account for paper being filed. These baseline high-grade paper procurement data have been used since that time to estimate recycling percents without accounting for changes in the number of personnel on base or changes in unit missions.

Table 3 compares the estimated recycling rates for WPAFB versus national. In each case, the estimated recycling rates for WPAB are significantly lower than national rates. High-grade paper recycling was estimated to be only 40 percent of the national rate. WPAFB recycling rates for metal containers are even lower; however, these items are purchased by employees and most are collected for recycling by employees rather than being placed in facility collection containers.

Table 3. WPAFB and National Recycling Rates Compared

1995 Recycling Rates		
	WPAFB* (*Meinerding, 1996)	Nationwide** (**EPA, 1998)
Plastic Bottles	2%	41%
Glass Bottles	11%	35%
High-Grade Paper	10%	26%
Old Newspaper	15%	53%
Cardboard	14%	65%
Steel Cans	2%	57%
Aluminum Cans	6%	62%

Section Summary. The 1995 national recycling rate for high-grade paper was 25.7 percent, but it was not possible to compare air Force or AFMC the national rate, nor is it possible to compare current Air Force and AFMC rates with the national rate, because Air Force units do not collect the data necessary to calculate recycling rates. The only data collected by most Air Force units up through the present relates to the mass of high-grade paper being recycled, not recycling rate. As noted in Chapter II, the paper procurement processes within the Air Force do not provided data concerning the amount of high-grade paper purchased, therefore recycling rates cannot be calculated.

The previous and current Air Force goals relating to waste reduction refer only to tons of waste reduced or diverted form landfills. Goals have not been established for recycling rates of the overall mass of material, or for individual recyclables.

WPAFB is the only base within AFMC which estimates its recycling rates; however, the data used to compute those rates is incomplete and actual rates may vary considerably from the estimated rates. The WPAFB estimated recycling rates are far below national averages which, in the case of high-grade paper, are not themselves very high. High-grade paper is the most salable of the various paper recyclables and it would seem logical that high-grade paper would have the highest recycling rate, but this is not true for either the nation or WPAFB.

Program Management Elements

Introduction. The first portion of this section outlines a variety of source materials which contain one or more references to activities that can be classified as program management elements. Only those portions of the reference material which are pertinent to this study are provided. There is a short summary at the end of each source section listing those program management elements noted in the section

The second subsection is a table that depicts which program management elements were present in each of the reviewed sources. The third subsection is a listing of the major program management elements with definitions and comments as to what constitutes a proper application of those elements according to Air Force and non-Air Force documents. The final subsection summarizes the previous three.

Source Documents.

Linkage Study. A study was performed by Roberts and Gehrke, (1996) of the School of Natural Resources, The Open Polytechnic of New Zealand to determine whether a relationship exists between accepted best business practices and environmental performance by companies. The authors first developed a rating system for evaluating environmental performance based on work accomplished by other authorities in the field. A best practice model adopted by the Australian Manufacturers Council was used by the authors to evaluate company business performance. The scores from these two

evaluations are then statistically analyzed, and a positive correlation of .85 (r = 0.85) was found to exist between environmental performance and business practices.

The study specifically addressed a number of practices that could be classified as program performance elements (Roberts and Gehrke, 1996:190-193):

1. Management priority.

2. Resource commitment.

3. Monitoring and internal reporting.

4. External reporting.

5. Employee training.

6. Objectives and targets.

7. Strategy/planning.

8. Policy.

ISO 14000. The International Organization for Standardization (ISO) is a worldwide federation founded in 1947 to promote the development of international trade, manufacturing, and communication standards (Hemenway, 1995:3). ISO is composed of members from more than 100 countries, including the U.S. The U.S. representative is the American National Standards Institute (ANSI). ISO 14000 is a new series of standards developed by ISO to provide organizations with a recommended structure for managing environmental programs. Two standards were published by ANSI in September 1996:

ISO 14001: Environmental Management Systems - Specification with Guidance for Use.

ISO 14004: Environmental Management Systems - General Guidance on Principles, Systems and Supporting Techniques.

ISO 14001 is the only standard in the series which is used for auditing purposes for those companies which wish to receive ISO 14000 certification and registration. It specifies the requirements for an environmental management system (EMS) to enable an organization to formulate a policy and objectives taking into account legislative requirements and information about significant environmental impacts (Hemenway, 1995:8). ISO 14001 concerns the environmental management system, the part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy (ISO, 1996:2). The following is a condensed version of the ISO 14001 requirements detailed in paragraph 4 of the standard. There are five general requirements for certification:

1. Environmental Policy. Top management shall establish an environmental policy which:

a. Is appropriate to the nature, scale and environmental impacts of its activities, products or service.

b. Includes a commitment to continual improvement and prevention of pollution.

c. Includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes.

d. Provides the framework for setting and reviewing environmental objectives and targets.

e. Is documented, implemented and maintained and communicated to all employees.

f. Is available to the public.

2. Planning. The planning requirements of ISO 14001 include the following:

a. The organization shall identify environmental aspects of its activities and shall consider these impacts in setting its environmental objectives.

b. The organization shall be aware of legal requirements applicable to the environmental portion of its activities.

c. The organizations shall establish and maintain documented environmental objectives and targets, at each relevant function and level within the organization. The objectives and targets shall be consistent with the environmental policy, including the commitment to prevention of pollution.

d. The organizations shall have a program for achieving its objectives and targets including designation of responsibility at each relevant

function and level of the organization and the means and time frame by which they are to be achieved.

3. Implementation and Operation. Paragraph 4.4 of ISO 14001 contains a number of requirements relating to program operation:

a. Roles, responsibilities and authorities shall be defined, documented and communicated.

b. Management shall provide resources essential to the implementation and control of the environmental management system.

c. Top management shall appoint a specific management representative who has responsibility and authority for ensuring that management system requirements are established, implemented and maintained in accordance with ISO 14001, and for reporting performance of the system to top management.

d. All personnel whose work may create a significant impact upon the environment shall have appropriate training.

e. Employees at each relevant function shall be made aware of the environmental management system, the significance of the environmental impacts of their work, their roles and responsibilities, and the potential consequences of not complying with procedures. Relevant employees shall be competent in accordance with education, training and experience.

f. Procedures for internal and external communication relating to environmental aspects shall be established.

g. Information concerning the environmental management system shall be documented. This documentation shall be readily available, current, and reviewed by management.

h. Ensure that environmental activities are carried out as specified by policy, objectives and targets.

i. Establish emergency response procedures.

4. Checking and Corrective Action. Paragraph 4.5 concerns control procedures:

a. The organization shall monitor and measure its environmental activities, record data, track performance, and evaluate compliance with regulations.

b. Responsibility shall be assigned for correcting nonconformance.

c. Environmental records shall be maintained which include training as well as audits and reviews.

d. Self-audits shall be done to determine whether the system conforms to plans and to ISO 14001. Results of audits shall be provided to management.

5. Management Review. The organization's top management shall, at intervals that it determines, review the environmental management system, to ensure its continuing suitability, adequacy and effectiveness. The management review process shall ensure that the necessary information is collected to allow management to carry out this evaluation. This review shall be documented.

Annex A of the standard provides further explanation and detail concerning the above requirements.

ISO 14004, EMS - General Guidelines on Principles, Systems, and Supporting Techniques, is a guidance document based on five principles which support the five core elements of ISO 14001 (ISO, 1996:3):

Principle 1: An organization should define its environmental policy and ensure commitment to its EMS.

Principle 2: An organization should formulate a plan to fulfill its environmental policy.

Principle 3: For effective implementation, an organization should develop the capabilities and support mechanisms necessary to achieve its environmental policy objectives.

Principle 4: An organization should measure, monitor, and evaluate its environmental performance.

Principle 5: An organization should review and continually improve its EMS with the objective of improving its overall environmental performance.

ISO 14000 requirements that fit the definition of program management elements include: policy, objectives/targets, management priority, accountability /reporting, strategy/planning, resource commitment, monitoring/metrics, and training.

Compliance with the ISO 14000 series of standards is voluntary unless an organization wishes to become certified. In that case, only the 14001 standard is used for certification. A key question is whether the requirements of ISO 14001

apply just to an organization's overall program, to major sub-elements of an

organization's environmental management system, such as its recycling

program. Richard James of the Washington, D.C. branch of ANSI, who is

responsible for the auditing portion of the ISO 14000 series of standards, stated

that organizations wishing to achieve ISO 14001 certification must comply with

the standard criteria in all major portions of their program, including recycling.

That is, if a major sub-program such as the recycling program does not meet the

ISO 14001 standards, the overall program will not be certified (James, 1996).

The Air Force has not yet indicated a desire to pursue certification by ISO

but, individual units may do so if they wish. Others may use the ISO standards

as a guide for evaluating their own programs

PUBLIC LAW 103-62 - The Government Performance and

Results Act of 1993. The Government Performance and Results Act of

1993 was enacted by Congress to "provide for the establishment of

strategic planning and performance measurement in the Federal

Government." In this Act, Congress recognizes the importance of

planning, establishing goals and objectives, accountability, developing

quality performance indicators, and focusing on results when managing

programs of any type. In the Act, Congress mandates that these activities

be implemented for certain government agency programs.

In Section 2 of the Act, Findings and Purposes, Congress states in part that:

(1) Waste and inefficiency in Federal programs undermine the confidence of the American people in the Government and reduces the Federal Government's ability to address adequately vital public needs.

(2) Federal managers are seriously disadvantaged in their efforts to improve program efficiency and effectiveness because of insufficient articulation of program goals and inadequate information on program performance.

Purposes of the Act include the following:

(1) Improve Federal program effectiveness and public accountability by promoting a new focus on results, service quality, and customer satisfaction.

(2) Help Federal managers improve service delivery by requiring that they plan for meeting program objectives and by providing them with information about program results and service quality.

Under Section 3, Strategic Planning, the Congress requires the head of each agency to submit a strategic plan for program activities. This plan shall include among others:

(1) A comprehensive mission statement covering the major functions and operations of the agency.

(2) General goals and objectives, including outcome-related goals and objectives, for the major functions of the agency.

(3) A description of how the goals and objectives are to be achieved, including a description of the operational processes, skills and technology, and the human, capital, information, and other resources required to meet those goals and objectives.

Section 4 of the law, Annual Performance Plans and Reports, requires that each program activity set forth in the budget of an agency shall incur certain requirements including:

(1) The establishment of performance goals or objectives to set the level of performance to be achieved by a program.

(2) The expression of such goals in objective, quantifiable, and measurable form unless authorized to be in an alternative form.

(3) The establishment of performance indicators to be used in measuring or evaluating outputs, service levels, and results of each program.

(4) The comparison of actual program results with the established performance goals.

(5) Methods to be used to verify and validate measured values.

In this law, Congress has recognized the importance of several program management elements as described in this study: goals and objectives, strategy/planning, resource commitment, monitoring/metrics, and accountability and reporting.

Advanced Project Management Handbook. This handbook was developed by Stanley E. Portny and Associates and provides detailed instructions on how to manage projects and programs (Portny, 1992). The developers teach project management courses at installations throughout the DoD and their handbook is provided as a reference for those with project or program management responsibilities. Projects differ from programs in three ways:

1. Projects have a definite, one-time product.

2. Projects have definite start and end dates.

3. Projects have a specified total resource ceiling.

Other than the three items noted above, projects and programs are the same, thus management processes that apply to projects would apply equally well to programs. Portions of the handbook which would apply to both projects and programs are outlined below:

Phases. The APMH divides program and projects into four major phases that describe organizational activities:

1. Conception phase. The conception phase specifies the requirements which must be met.

2. Definition phase. During the definition phase, resource budgets are determined and management commitment and support is obtained.

3. Organization and start-up. During organization and start-up, policies, procedures and guidelines are prepared; an organization structure is formalized; responsibilities are assigned.

4. Execution phase. The execution phase includes measuring performance and diagnosing problems.

Management Activities.

1. Planning. Planning entails specifying objectives and estimating resource requirements.

2. Organization. Organization entails assigning authority and responsibility and establishing reporting relationships.

3. Control. Control involves monitoring performance, preparing reports, and taking corrective action when necessary.

4. Accountability. Accountability is defined as the active process of holding one answerable for the successful or unsuccessful performance of responsibilities.

5. Responsibility of top management. Responsibilities of top management include assigning responsibility and authority, establishing policy for setting resource priorities, identifying goals, and insuring the creation of operation of adequate management information systems.

6. Goals and objectives. Establishment of goals and objectives are essential to success.

7. Performance measurement. A performance measure is defined as a data item which represents the extent to which a specified objective is achieved. Each objective should have at least one performance measure associated with it.

8. Management information system. A management information system is defined as a set of procedures and equipment for collecting, analyzing, storing and reporting descriptors of performance.

9. Reporting. Reports are required to: identify and document progress, identify and document problems, provide a historical record, provide a basis for management action, and provide proof of conformance with requirements.

The Advanced Project Management Handbook references the following program management elements: policy, goals and objectives, management priority, accountability and reporting, strategy/planning, resource commitment, and monitoring/metrics.

Best Manufacturing Practices. Best Manufacturing Practices (BMP) is a program sponsored by the U.S. Navy and is a joint effort between the Navy, the U.S. Commerce Department, and the University of Maryland. BMP was chartered in 1985 with the primary objective of identifying best practices in industrial and other types of organizations, including military organizations, documenting them, and encouraging industry and government to share information about them (BMP, 1995:4). In 1993, the U.S. Congress directed the Office of Naval Research to form the Best Manufacturing Practices Center of Excellence (BMP, 1995:8). The BMP vision statement reads as follows: "To provide a national resource to foster the identification and sharing of best practices being used in government, industry and academia: and to work together through a cooperative effort aimed at strengthening the U.S. industrial base and its global competitive system" (BMP, 1995:preface). Although the word "manufacturing" is used in the name of the organization, the interests of BMP involve all activities that take place in the organizations they evaluate. These may be actual manufacturing process, or they be management practices, environmental practices, or any other organizational activity that may be worthy of adoption by other organizations.

Surveys searching for best manufacturing practices begin with a request from an interested organization. A BMP team then makes a pre-survey visit to determine needed membership for the survey team. During the actual BMP survey, the BMP team shares applicable best practices with the organization from the BMP file. BMP defines a best practice as "a process, technique or innovative use of equipment or resources that has a proven record of success." To aid in identifying best manufacturing practices, the BMP team uses guidelines and templates that identify the characteristics of best practices. Once a new best management practice is identified, it is added to the Internet file which now contains more than 3,000 individual best practices (BMP, 1995:2). Finding best manufacturing practices for a particular topic is accomplished through use of the BMP search engine.

BMP Recycling Criteria. The following criteria are considered by the BMP staff to be essential to a superior organization recycling program (Brotherson, 1996:2-20):

1. Written recycling policy. This can be included in the mission statement or purchasing policy.

2. Establishment of program goals. Goals should be time-based and numerically specific. Goals should provide motivation. Goals should be stated so that employees are accountable for results.

3. Accountability. Assign responsibility to a program manager. The program manager should have overall responsibility for implementing a resource recovery and recycling program.

4. Determine required resources. The program manager should be able to dedicate 100 percent of his/her time to the program. A team should be established to assist the program manager. Adequate equipment and facilities should be made available.

5. Management support/emphasis. Management support and emphasis should be provided.

6. Monitor progress. Document problems and solutions.

7. Establish metrics. Metrics should be in terms of percent recycled (recycled/reused amounts divided by the total waste generation). The desired trend is an increase in the annual recycling percentage. It judges the effectiveness of the recycling efforts.

8. Educate organization personnel. A comprehensive training program will help to foster an in-depth awareness about environmentally sound recycling practices. It will also help promote an overall positive environmental behavior in all employees.

9. Publicize the program. Posters, newsletters, reports, and organizational publications may be use to promote the program.

10. Provide progress reports. These can include percents and amounts recycled; savings generated, and amount of products purchased containing recycled material. These reports allow management and organization personnel to see progress and feel that efforts are going toward the achievement of a tangible goal.

The BMP recycling program evaluation criteria include policy, goals and objectives, management priority, accountability and reporting, resource commitment, monitoring/metrics, training, and publicity.

Summary of Program Management Elements. Figure 16 provides a summary of the various management actions defined by this study as "program management elements" that were referenced in each of the above source documents: policy, objectives/goals/targets, management priority, accountability/reporting, strategy/planning, resource commitment, monitoring/metrics, training, and publicity. The figure depicts the specific program management elements that were found to be present in each of the referenced source documents.

BMP	APMH	GPRA	ISO 14000	Linkage Study	
x	x		x	x	Policy
x	x	x	x	x	Objectives/Targets
x	x		x	x	Management Priority
x	x	x	x	x	Accountability and Reporting
	x	x	x	x	Strategy/Planning
x	x	x	x	x	Resource Commitment
x	x	x	x	x	Monitor/Metrics
x			x	x	Training
x					Publicity

Figure 16.   Source Documents and Included Program Management Elements

Program Management Elements—Description and Requirements. This section discusses each of the program management elements identified in the previous section, further defining the individual elements and their proper application.

Policy. Quinn (Mintzberg and Quinn, 1996:4) defines policies as rules or guidelines that express the limits within which action should occur. He says these rules often take the form of contingent decisions for resolving conflicts among specific objectives. Policies are written statements that reflect a plan's basic values and provide guidelines for selecting actions to achieve objectives. Collins and Devanna (1990:349) say a policy is a decision rule, not a decision. Plunkett and Attner (1994:67) define a policy as a broad guideline created by top management to help managers workers deal with ongoing and recurring situations. Policies are essential guides for managers in performing their daily duties.

Effective policies have the following characteristics (Ivancevich and others, 1994:186):

1. Flexibility. A policy achieves a balance between rigidity and flexibility.

2. Comprehensiveness. A policy must cover multiple contingencies.

3. Coordination. Activities must conform to the policy without building conflict across activities.

4. Clarity. The policy must specify the aim of the action, define appropriate methods, and describe the limits of discretion provided to those applying the policy.

5. Ethical. A policy must be ethical and responsive to the culture of the nation.

Plunkett and Attner (1994:111) list six requirements for proper policies:

1. Should be in writing.

2. Needs to be communicated and understood.

3. Should provide some flexibility.

4. Should be consistent throughout the organization and be consistently applied.

5. Should support the organization's strategy.

6. Needs to be based on the mission.

Goals and Objectives. Ivancevich and others (1994: 176) say goals are future states or conditions that contribute to the fulfillment of the organization's mission. Mintzberg (Mintzberg and Quinn, 1996:3) says goals state what is to be achieved and when results are to be accomplished--but not how the results are to be achieved .

Goal-setting research emphasizes the role of conscious intentions in work. That is, people who set goals outperform those who don't set goals (Ivancevich and others, 1994:374).

There are a number of advantages to the organization in setting goals and objectives (Ivancevitch and others, 1994:374):

1. Goals direct attention and action of workers and management.

2. Goals aid in mobilizing efforts toward mission achievement.

3. Goals create consistent, steadfast behavior over time.

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4. Goals lead to innovation of strategies for goal attainment.

Five factors that increase the probability that employees will accept a goal and become committed to it are (Hollenbeck and Klein, 1987: 212-20):

1. Goal specificity. Specific goals are more effective than those that are unclear or ambiguous. Being specific means including four elements: an action verb, desired outcome, timeline, and cost. The verb dictates the action to be taken; the outcome should be stated as a single, measurable result; the timeline establishes when the goal should be accomplished, and the cost identifies the resources that will be expended to reach the goal.

2. Goal difficulty. Goals that are difficult, but attainable, motivate higher performance than easy goals which do not challenge the workers or the organization. Establishing a difficult but attainable goal is done by utilizing relevant data, knowledge, and skills.

3. Goal feedback.

4. Participation in goal setting.

5. Competition. Competition between organizations or against a competitive standard can be the most effective way to improve goal directed performance.

Ivancevitch and others (1994:209) define goals as follows:

> Organizational goals are the end points or targets stemming from the organization's mission. Goals define what the organization seeks to accomplish through its ongoing, long run operations. Effective goals are capable of being converted into precise actions and shorter-term objectives. Clear goals tell employees where they should direct their efforts, without creating doubt about the firm's intentions. All employees can interpret and

understand an effectively state goal. Goals facilitate management control, serving as standards against which the firm's performance will be measured. Clear goals and objectives help employees track progress by providing precise targets and immediate feedback .

Of the essential elements for effective strategy, goals and objectives are the most important. Goals and objectives should be clearly understood, decisive, and attainable (Mintzberg and others, 1995:8-9). All behavior is goal oriented (Hersey, 1993:19). Ivancevich and others state that goals and objectives are needed in each area where performance influences effectiveness and that if goals and objectives are adequately established, they will dictate what results must be achieved and the measures that indicate whether they have been achieved (Ivancevich and others, 1994:140).

Accountability and Reporting. The Alberta legislature defines accountability as an obligation to answer for the execution of one's assigned responsibilities (Alberta, 1977). The basis factors required for successful accountability relationships are stated as:

1. Set measurable goals and responsibilities.

2. Plan what needs to be done to achieve goals.

3. Do the work and monitor progress.

4. Report results.

5. Evaluate results and provide feedback.

In their book Reengineering the Corporation, Hammer and Champy (1993:27) state that one problem with many organizations is that they are task orientated, not process orientated. That is, functions of the organization are

broken down into tasks that are accomplished by various departments. The problem arising out of this according to Hammer and Champy is that no one is responsible or accountable for the overall process to which these tasks contribute. Each department may appear to be accomplishing its tasks in an efficient manner, but lack of proper interaction between the departments or other inefficiencies often means that the overall process is poorly done because no one is accountable for the overall process.

Plunkett and Attner (1994:211) consider accountability to be a part of a four-step delegation process:

1. Assignment of tasks. Tasks or duties are assigned to subordinates by higher levels of management.

2. Delegation of decision-making authority. Authority necessary to accomplish the assigned tasks is delegated.

3. Acceptance of responsibility. Responsibility is the obligation to carry out one's assigned duties to the best of one's ability.

4. Creation of accountability. Being answerable for your actions creates accountability, an obligation to accept the consequences.

Classical management (Ivancevitch and others, 1994:136) assigns the subject of responsibility and accountability to the topic of scalar process which deals with the delegation of authority and responsibility, unity of command, and the obligation to report. The assumption is made that proper authority has been delegated to responsible persons so that they actually have the ability to carry out their assigned duties. It implies that there is someone in charge of every

task, process or function that can be held accountable for success or failure. This classical management view is still considered essential in new management control system designs. The National Performance Review (NPR, 1997), the Clinton-Gore Administration's initiative to reform the way the federal government works, states that managers must be accountable for, and have authority over, management processes and systems.

The Advanced Project Management handbook states that reports are required to identify and document progress, identify and document problems, provide a historical record, provide a basis for management action, and provide proof of conformance with requirements (Portny:IX-1). Reporting is listed as one of the ten essential recycling program criteria by the Navy BMP (Brotherson:1996).

Plunkett and Attner (1994:46) say that a key ingredient in management science is the timely and efficient delivery of up-to-date information. Without such information, managers cannot make timely and appropriate decisions.

ISO 14001, paragraph 4, states that:

> The organization's top management shall, at intervals that it determines, review the environmental management system, to ensure its continuing suitability, adequacy and effectiveness. The management process shall ensure that the necessary information is collected to allow management to carry out this evaluation.

The essence of these various references is to assert the importance of accountability and reporting in the conduct of program management if successful results are to be expected.

Strategy/Planning. In their text, The Strategy Process, Mintzberg and Quinn (1996:2) report that there is no single accepted definition of strategy. The text contains a number of definitions which have evolved over time. Originally, the Greek word *strategos* referred to the role of a general in command of his army. In time, it came to mean "the art of the general." In 450 BC, it referred to managerial skill. By the time of Alexander (330 BC), it signified the skill of employing forces to defeat opposition. Mintzberg and Quinn (1996:3) state that, whether it is used in a military sense or a business sense, the concept of strategy now has come to mean the same in each case and the authors included both military and business examples in their text for the purpose of demonstrating strategy.

Quinn's (Mintzberg and Quinn, 1996:3) definition of strategy is the pattern or plan that integrates an organization's major goals, policies, and action sequences into a cohesive whole. A strategy provides a continuing basis for directing these adaptations toward broader purposes. A key strategy refers to a longer-range, overall view of goal accomplishment rather than attainment of short-range objectives, even though attainment of those short-range objectives may contribute to eventual goal accomplishment.

In their text, Management Quality and Competitiveness, Ivancevich and others (1994:202) envision strategy or strategic planning as a pattern or plan that integrates an organization's goals, policies, and actions into a cohesive whole, a guide that can be used for future action. He states that strategy and strategic planning are necessary for long-run success and that strategic planning never

ends. It also requires continuous improvement over the course of the plan (Ivancevich and others, 1994:204).

Effective Strategy. Quinn lists five elements as being necessary for any strategy to be effective (Mintzberg and Quinn, 1996:9):

1. Clear, decisive objectives: All efforts must be directed toward clearly understood, decisive and attainable goals.

2. Maintaining the initiative: Efforts must be proactive rather than reactive.

3. Concentration: The emphasis must be on efficient use of resources in a way that will yield the most favorable results.

4. Flexibility: The strategy must be altered as the environment changes or as new knowledge becomes available.

5. Coordinated and committed leadership: A successful strategy requires commitment, not just acceptance.

Types of Strategy. Mintzberg describes five types of strategies referred to as the five Ps (Mintzberg and Quinn, 1996:10):

1. Position: Locating an organization in a favorable environment.

2. Perspective: Commitment with an organization's culture.

3. Ploy: A strategy designed to succeed through subterfuge.

4. Pattern: A stream of actions that define a strategy.

5. Plan: A consciously intended course of action.

Sample waste reduction strategies are shown in Figures 17 and 18.

SOLID WASTE MANAGEMENT
FOCUS & STRATEGY

- AFMC achieved 55% reduction in SW sent to Landfills in CY96, against 50% target by CY97
- Plan to maintain or exceed this level in a <u>cost effective</u> manner in the out years
  - Minimize QRP shortfall, by adopting a flexible recycling Program - Pare unprofitable items; concentrate on profitable items; increase cost consciousness at all levels
- Concentrate on Composting to offset dependence on recyclable markets in the long run
- Focus on Source Reduction as a long term solution

Figure 17. Solid Waste Reduction Strategy (Annamraju, 1996)

HAZARDOUS WASTE MANAGEMENT
FOCUS & STRATEGY

- AFMC achieved 42% reduction in HW in CY96, against 50% target by CY99
- Plan to achieve & maintain 50% level in a <u>cost effective</u> manner by CY99 and in the out years
- Short term - End of Pipe - Focus on IWTP sludge reduction at all ALCs; PMB waste reduction; HW recycling on-base and off-base
- Long Term - Continue cost effective source reduction at the front end of pipe through HM control, Process improvements and innovations to achieve as close as possible the zero discharge status

Figure 18. Hazardous Waste Reduction Strategy (Annamraju, 1996)

<u>Resource Commitment</u>. Plunkett and Attner (1994:21), state that people are any organization's most valuable resource and that one of the most important decisional roles of a manager is resource allocation—determining who gets what resources. Ivancevich and others (1994:24) say that resource allocation is one of management's most critical decisional roles. Collins (1990:13) says that successful strategies mean that adequate resources must be

made available in order to accomplish those strategies. ISO 14000 (ISO, 1996) requires management to provide the resources essential for implementation and control of the environmental management system. The GPRA (USC, 1993) directs government agencies to include in their strategic plan of program activities the human, capital, and other resources required to meet the plan's goals and objectives.

The thrust of these statements is that resource commitment is a fundamental requirement of successful program management.

Monitoring/Metrics. ISO 14000 (ISO, 1996) states that organizations shall monitor and measure their activities, record data, track their performance, and evaluate compliance with regulations. In the GPRA (1993) Congress directs federal agencies to establish performance indicators to be used in measuring and evaluating outputs, service levels, and results of each program. The APMH (Portny, 1992) says that control involves monitoring performance and defines a performance measure as a data item which represents the extent to which a specified objective is achieved. Each objective should have at least one performance measure associated with it. The BMP (1995) recycling program evaluation criteria include establishing metrics and monitoring progress.

As documented by the above sources, monitoring program performance through use of suitable performance indicators/metrics is an essential element of program management.

Employee Training. The McGraw-Hill Recycling Handbook (Lund, 1993:31.1) cites a number of primary areas of competency generally required for those who work in the recycling career field:

1. Knowledge of funding and revenue resources.

2. Knowledge of cost accounting.

3. Knowledge of markets and market trends.

4. Knowledge and skill in recycling program management.

5. Knowledge and ability to promote and publicize recycling programs.

6. Knowledge of pertinent laws.

7. Knowledge of monitoring/metrics.

8. Knowledge of composting methods and techniques.

9. Knowledge of design and implementation of recycling programs for multifamily and institutional/commercial and industrial sectors.

Training needs should be defined in terms of desired performance outcome and should be specific for each individual. The following steps should be accomplished (Lund, 1993:31.1):

1. Define the full list of performance requirements (competencies) for the job function.

2. Evaluate the list generated above and note whether the competency requires information or knowledge of a particular subject, or whether it requires a proficiency in a certain skill.

3. Describe the gap between the current ideal level of proficiency in each competency area for the program manager and staff.

General rules for effective training include (Lund, 1993:31.6):

1. Ensure that the information or skill being addressed in the training is relevant and practical.

2. Allow for practice and application of the new information or skill.

3. Provide opportunities for participants to share their experiences with others.

4. Limit length of lecture periods.

5. Use a variety of training techniques

Managing and delivering training (Lund:31.6-31.9) involves fours steps:

1. Design a training plan.

2. Set objectives and monitor progress in accomplishing each objective.

3. Build training opportunities into the daily work environment.

4. Make use of outside resources.

Publicity. According to Lund (1993:92), a recycling program's success or failure depends overwhelmingly on adoption by the entire organization. Education and information are the keys to successful recycling programs (Lund, 1993:5.26). Failing to consider publicity may cause the most organized recycling program to fail (Lund, 1993:30.1). Lund lists a number factors essential to a successful recycling education and publicity program:

1. Research. The particular audience to be communicated with must be understood so that the message can be tailored to the audience and thereby persuade the majority of individuals to participate in the program.

2. Audience Identification. Audiences can best be identified by direct interviews with potentially affected individuals.

3. Identifying Resources. Effectiveness of publicity can be increased while keeping costs down by utilizing outside sources such as community groups, the media, public schools, and community events.

4. Planning. Goals and objectives of the publicity campaign should be determined before it begins and should consider resources, schedule, staffing and audience identification.

5. Recycling Message and Media Strategies. Message and media strategies should be in accordance with the audience being targeted. The most successful strategies are those that incorporate as many points of contact with the organization as possible (Lund, 1993:30.11).

6. Scheduling. Publicity should start at least several months prior to kickoff, but not so early that it is forgotten by the time the date arrives. Publicity should attempt to saturate targeted audiences prior to startup, but may be reduced after the program becomes integrated into community activities. The 'how to' portion of the program should be emphasized as well as the 'why' portion. Persuasion should always try to convince individuals that participation is beneficial to them.

7. Barriers. Persuasion should attempt to overcome perceived barriers such as inconvenience by emphasizing the positive benefits of participation.

8. Being Audience-Specific. Benefits touted in publicity campaigns should be tailored to that which could be expected to be effective with that particular audience.

9. Information that is clear, positive and often repeated is best. Step-by-step information about the who, what, when, and how is critical.

A number of suggestions are made concerning the design of posters and related materials (Lund, 1993:30.17-30.21):

1. Materials should be readable, uncluttered, and simple, with a mixture of text and illustrations.

2. The text should be large and easy to read.

3. Allow for a certain amount of white space.

4. Wording should be aimed at the average reading level. Avoid technical terms.

5. Keep illustrations relatively simple.

6. Use color if economically practical.

7. Print on recycled material.

Management Priority. Management support and emphasis is listed by Brotherson (1996:10) as one of the eleven most essential recycling program criteria.

The AFRRRPG (DAF, 1995b:1-2) states that "Support from the installation's senior leadership and other organizations is essential to the Resource Recovery & Recycling Program's success"

Plunkett and Attner (1994:402) state that it is necessary for management to effectively and clearly communicate desired behaviors and their outcomes. Kuper (1998:15) says there are many reasons for failure including the failure to address and/or overcome lack of top management support. According to Lund (1993:11.18), upper management support is necessary to properly implement a recycling program.

Logically, the degree to which management priority is present or absent within a program could be assessed by evaluating the presence or absence of the other eight program management elements: policy, goals/objectives, accountability and reporting, strategy/planning, resource commitment, monitoring/metrics, education/training, and publicity.

Summary of Program Management Element Descriptions and Requirements. This final section further defined the meaning of the selected program management elements and provided additional support to the thesis that they are essential to the proper and effective functioning of a recycling program. Figure 19 provides a summary of the program management elements (PMEs) and their characteristics as presented in this chapter and the sources from which they were obtained.

Source → / Program Management Element/Characteristic ↓	ISO 14000	Government Performance and Results Act	Best Manufacturing Practice	Advanced Project Management Handbook	Linkage Study	Ivancevich et al.	Plunkett and Attner	Hollenbeck and Klein	Mintzberg and Quinn
Policy	X		X	X	X				
Flexible						X	X		
Comprehensive						X			
Consistent	X					X	X		
Clear/Communicated	X					X	X		
Ethical	X					X			
Written	X						X		
Supports Strategy							X		
Mission-Based	X						X		
Goals/Objectives	X	X	X	X	X				
Specific								X	
Difficult								X	
Feedback								X	
Participative								X	
Competitive								X	
Accountability/Reporting	X	X	X	X	X				
Assign Goals	X	X	X	X					
Plan to Achieve Goals	X	X	X	X					
Monitor Progress	X	X	X	X					
Report Results	X	X	X	X					
Evaluation & Feedback	X	X	X	X					
Delegation Process	X		X	X					
Strategy/Planning	X	X		X	X				
Clear Objectives									X
Maintain Initiative									X
Efficiency									X
Flexibility									X
Committed Leadership									X
Resource Commitment	X	X	X	X	X				
Monitoring/Metrics	X	X	X	X	X				
Training	X		X		X				
Publicity			X						
Management Priority	X		X	X	X				

Figure 19. Summary of PMEs, Characteristics and their Sources

V. Findings and Analysis

Introduction

   An attempt was made to gather material from diverse sources to establish a basis for analysis. These sources included scholarly journals, trade periodicals, industry brochures and fact sheets, management texts, recycling texts, international standards, public laws, executive orders, EPA documents, DoD policy documents, Air Force regulations and various guidance publications, AFMC guidance documents, private industry and commercial guidance, and a wide variety of environmental material available on the internet. Among these categories, relevant material in referenced journals is relatively limited. Material from trade journals and private environmental organizations was intentionally limited due to the possibility of inherent bias prevalent among such sources.

   These source documents were not selected at random, but with specific intent in mind. Documents and materials selected are generally not obscure or difficult to find; instead Air Force program managers are likely to be aware of and have ready access to them. That is, the program management elements that are the concern of this study, and which will be recommended for application to the Air Force and AFMC high-grade paper recycling program, are contained in public law, presidential directives, international environmental guidance, EPA publications, and numerous Air Force documents, some of which are directive in nature. Nor were the documents noted above chosen at random.   Many

references are environmental or management books that are currently being used, or have been used, as assigned course texts in graduate-level programs.

Two additional sources, BMP and the Advanced Project Management Course, fit the same criteria. The BMP is a nationally known U.S. Navy, Department of Commerce, and University of Maryland jointly operated program that has been recognized by Congress. The BMP evaluates business and military organizations throughout the U.S., providing all member organizations with results of each evaluation. The purpose of the program is to identify and publicize best management or business practices in use by the various organizations that are evaluated. Additionally, the BMP maintains an Internet site that allows viewer to download information concerning evaluated organizations and identified best business practices. Portny and Associates' Advanced Project Management is a course being conducted for Air Force personnel on a periodic basis by an Air Force contractor at Air Force expense. That particular course includes all ten of program management elements identified in this study.

Recycling Data

The recycling data presented in the first section of Chapter IV do not allow for complete evaluation of AFMC high-grade paper recycling program progress or effectiveness. The one metric being briefed to upper level management at Air Staff through 1997 depicted only reductions in the mass of material being sent to landfill. These data did not include material sent to incineration. That is,

incineration was one method by which landfill disposal was reduced. Further, although AFMC corrected its data to some extent to allow for bases that had closed, Air Staff did not require other commands to do so. Nor did any command correct for the significant reductions in force that were taking place throughout that period. As a result, an unknown portion of the reported reductions were achieved with the aid of those two factors.

Air Staff maintains a second recycling metric that depicts actual mass of materials recycled annually by each command. However, this raw data, which includes composting, recycling, and incineration, do not provide a detailed picture of program effectiveness for individual recyclables because data for individual materials is nor provided nor are individual recycling rates provided.

AFMC data, although presented in a different way, provides similar information with a similar lack of useful detail, with the exception that the AFMC metric concerning tons recycled has a breakdown by type of material. The AFMC solid waste reduction chart shows progress toward a mass goal, but does not identify individual recyclables and their recycling rates. The AFMC material recycling chart does provide data concerning the mass of high-grade paper recycled by the Command, but does not provide recycling rates, thus it is not possible to judge from these data alone the effectiveness of the AFMC high-grade paper recycling program.

One exception to this lack of recycling rate data within AFMC is provided by WPAFB based on a 1993 contractor study. The WPAFB recycling program manger developed a percent-recycled metric for each of seven recyclable

materials using estimated disposal mass from the contractor study. As concerns

high-grade paper, the data collected by the WPAFB recycling program manger

do not include imbalances in the quantity paper coming onto or going off WPAFB

as through the mail system, nor differences in mass of documents being put into

or taken out of storage. However, the lack of this information does not prevent

computation of an accurate recycling rate. Combing the mass of high-grade

paper actually recycled with the disposed mass that could have been recycled,

and then dividing that total into the amount recycled provides an estimated high-

grade paper recycling rate. That is, material being stored or used in some

manner does not affect recycling rates. Only when the material is disposed of

does it enter into recycling rate calculations. The 1995 WPAFB high-grade paper

recycling rate was computed to be 10 percent, a rate significantly lower than the

average 26 percent being achieved nationally. The very low recycling rate for

high-grade paper within AFMC suggests that improved program management

methods, as identified in this study, are likely to drive substantially increased

recycling rates.

Policy

DoD, Air Force, and AFMC Policy. Sherri Wasserman Goodman,

Deputy Under Secretary of Defense (Environmental Security), issued a DoD

Policy on Recycling on 22 September 1993. Elements of this policy pertinent to

this study include the following:

1. Goals and Objectives. DoD installations are required to reduce, reuse, recover, and recycle materials, to purchase products containing post-consumer materials, and to procure new materials that are more easily recycled

2. Recycling Fundamentals. All DoD installations are required to have recycling programs and to have purchasing preference programs for products containing recycled materials and materials that are more easily recycled.

3. Program establishment. Each installation is required to have or be associated with an installation-wide Qualified Recycling Program (QRP) with a designated QRP coordinator.

4. Program Review. Each QRP is to be continually reviewed to identify materials appropriate for waste stream diversion, exploration of recycling methods, and identification of potential markets

5. Accountability and Reporting. Records concerning quantity and types of materials recycled and proceeds from sale are to be maintained for fiscal reporting requirements.

This policy was later supplemented by DoD instruction 4715.4 o f 18 June 1996 that established a 50 percent diversion goal using a 1992 baseline was to be reached by 1999, as well as a 50 percent recycling goal, also be reached by 1999. The recycling goal recognized that diversion by itself could include incineration, thus the recycling goal was intended to eventually eliminate incineration as means of accomplishing the diversion goal. The Air Force and AFMC metrics shown in Figures 13 and were consistent with the DoD diversion

goal, but neither Air Force nor AFMC established a recycling goal. On 26 Jan 1999 DoD issued a new goal of 40 percent continous diversion to be reached by 2004.

Policy Analysis. Figure 19 depicts an analysis of DoD recycling program policy as concerns the criteria described in Chapter IV. It is in writing; it is mission-based to the extent that recycling or diverting materials from landfill can reduce expense of mission operations, it is flexible since it does allows changes to the program based on future determination of what constitutes recyclable

POLICY CHARACTERISTICS								
Flexible	Comprehensive	Consistent	Clarity/Communicated	Ethical	Written	Supports Strategy	Mission-based	
X	X	X	X	X				Ivancevich and others
X		X	X		X	X	X	Plunkett and Attner
		X	X	X	X		X	ISO 14000
X	O	O	X	X	X	O	O	EVALUATION OF RECYCLING POLICY KEY: FULLY APPLIED X PRESENT TO SOME DEGREE O NOT PRESENT -

Figure 20   Policy Analysis Summary

materials, and it is ethical in that it supports to some degree socially desirable pollution prevention activities. However, it is weak in some critical areas.

The cited goal in the 28 September 1993 policy of recycling in order to prevent pollution and conserve resources was not as comprehensive as it might have been. For example, it discussed goals and objectives only in terms of generalities such as "prevent pollution and conserve resources," etc. Nor did it discuss the use of any type of metrics to measure program progress other than maintaining records for annual fiscal year reporting of quantity and types of material recycled, and data concerning proceeds from those sales. These deficiencies were corrected to some degree by the later DoD instruction, but goals for individual recyclables never were directed. The policy is not entirely consistent with national guidance promulgated by the EPA in that EPA guidance refers to recycling rates of individual recyclables rather than diversion of materials from landfill. Although the policy may support DoD's strategy, it is not possible to say positively because there is no discussion of strategy in the policy, nor is there any strategy guidance provided for the military services. This may explain in part why neither Air Force nor AFMC have issued policy or strategy guidance concerning their own recycling programs. In addition, the policy does not provide guidance in several areas in accordance with a policy's general purpose of providing decision-making guidelines. Guidance is not provided concerning resource allocation other than the requirement that each qualified recycling program have a coordinator and guidance is not provided concerning program emphasis and priority.

As noted, Air Force and AFMC do not have a recycling policy, nor are they required to do so by DoD policy or instruction. This lack of policy by Air Force

and AFMC violates basic certification requirements of ISO 14000 and presumably would prevent ISO approval of Air Force or AFMC environmental programs if requested. ISO evaluation personnel have previously stated that all major sub-elements of environmental programs must comply with all portions of the ISO 14001 standard if the overall program is to receive certification.

Goals/Objectives

Air Force and AFMC Goals. As described in Chapter IV, Hollenbeck and Klein listed five criteria for effective goals:

1. Specificity

2. Difficulty

3. Feedback

4. Employee participation in goal setting

5. Competition among organizations

Goal Analysis. Figure 20 depicts an analysis of AFMC recycling programs goals based on the criteria provided by Hollenbeck and Klein. The AFMC goal is specific as far as diversion is concerned, but does not provide specific goals for individual recyclables such as high-grade paper. Goal difficulty is somewhat lacking as AFMC was easily able to reach the 50 percent diversion goal several years ahead of time. The new 40 percent continuous goal may prove to be somewhat more difficult to achieve, still relatively easy. A goal for high-grade

Goal Characteristics					
Specificity	Difficulty	Feedback	Participation	Competition	
X	X	X	X	X	Hollenbeck and Klein

O	O	X	-	-	EVALUATION OF AFMC RECYCLING GOALS
					
					KEY: FULLY APPLIED X
					           PRESENT TO SOME DEGREE: O
					           NOT PRESENT -

Figure 21   Goals Analysis Summary

Paper of 20 percent that would gradually rise to 90 percent would be much more challenging if added to the existing diversion goal. Feedback concerning the diversion goal is made available to employees through the Internet. Employees do not participate in the setting of AFMC goals nor does competition exist between organizations.

The diversion rate goal has the benefit of being both cost efficient and convenient to administer, but does not provide motivation for organizations to improve recycling rates for individual recyclables such as high-grade paper because, as noted by Ivancevich in Chapter IV, goals tell employees where to direct their efforts and there is no high-grad paper recycling goal. A goal of waste diversion directs employee efforts toward that objective at the possible expense of improved recycling rates for individual recyclables such as high-grade paper. If on the contrary, a challenging goal such as 90 percent high-grade

recycling rate had been set, and progress toward that goal had been reported to Air Staff upper level management, it seems likely that the recycling rate for high-grade paper would be much higher than it currently is.

Accountability and Reporting

AFMC Program Accountability and Reporting. As reported in Chapter IV, the Alberta legislature describes five basic factors required for successful accountability:

1. Measurable goals and responsibilities.

2. Plan to achieve goals.

3. Monitor progress

4. Report results

5. Evaluate and provide feedback

Plunkett and Attner add a sixth item, the delegation process.

Accountability and Reporting Analysis. In Figure 21 these criteria are compared to those cited in four study references and are than evaluated for presence in the AFMC high-grade paper recycling program. Assignment of goals has been done, but only overall diversion goals, not specific individual material recycling goals. Planning to achieve goals does exist, but only for the diversion goals. Diversion progress is monitored, but individual material recycling progress. Diversion results are reported, but not individual material recycling results. Evaluation and feedback exists for diversion activities, but not for

Assign Goals	Plan to Achieve Goals	Monitor Progress	Report Results	Evaluation and Feedback	Delegation Process	Accountability Characteristics
X	X	X	X	X	X	ISO 14000
X	X	X	X	X		GPRA of 1993
X	X	X	X	X	X	BMP
X	X	X	X	X	X	APMH

O	O	O	O	O	O	EVALUATION OF ACCOUNTABILITY/REPORTING
						
						KEY: FULLY APPLIED X
						           PRESENT TO SOME DEGREE 0
						           NOT PRESENT -

Figure 22   Accountability and Reporting Analysis Summary

individual materials recycling, and delegation of tasks does exist, but not for improvement of individual material recycling rates.

Accountability. The material in Chapter IV concerning the concept of accountability and reporting emphasizes that responsibility must be assigned and individuals must be held accountable for the results of their performance. If individuals are held accountable for the results of their efforts, they will have a strong interest in seeing that the results are acceptable. If no one is being held accountable for the results of a particular program, it is likely that the results will be less than desired. Accountability is also related to goals, objectives, and

metrics. If goals and objectives don't exist, one cannot be held accountable for not accomplishing them. Also, if metrics or reporting is not required, accountability would be lacking because there would be no information flow to upper management indicating that an activity was not being accomplished as desired.

General Ronald Fogleman (1997) former Air Force Chief of Staff, directed that a video on the subject of accountability be prepared for mandatory viewing by all Air Force military members and senior executive service civilians. The contents were also distributed in print and placed on the Internet. In the video and written material, General Fogleman emphasized the importance of accountability and holding individuals accountable for their actions in their areas of responsibility. He further stated that accountability is critical to good order and discipline. General Fogleman stated that holding persons at all levels accountable for those actions and activities for which they are responsible is a mandatory element of acceptable command and leadership performance.

The essence of the above views is that if the task or process is to be properly accomplished, someone has to be assigned responsibility and held accountable for the results. This also implies that goals and objectives must be determined and that someone must be held accountable for achieving those goals and objectives. And even if goals and objectives for a program or process are established, success is not likely if specific individuals at various levels are not assigned responsibility and held accountable. Accountability also means that

there must be a practical method for measuring goal achievement (metrics) and that upper management be informed of progress or lack thereof (reporting).

The fact that individuals at various levels in the Air Force have not been given the responsibility for achieving specified high-grade paper recycling goals and objectives, and are not being held accountable for such achievement would imply that a successful high-grade paper program is unlikely. This lack of accountability in the Air Force for achieving even reasonably satisfactory high-grade paper recycling rates obviously has had a detrimental effect on results.

Reporting. Without status reports flowing upward, management cannot know whether programs are operating in a satisfactory manner, provide essential oversight, or take appropriate corrective action as necessary. Reporting is one of the essential recycling program processes according to BMP evaluation criteria and the Portny Advanced Management Project course book. Other authorities emphasize that management cannot make timely and effective decisions without timely and appropriate information. Currently, the only data related to the recycling program that is briefed to upper Air Force management concerns the volume of material diverted from land disposal. Without knowledge of Air Force recycling performance versus that of other organizations nationally, Air Force management is unlikely to be aware of or be concerned about possible sub-standard performance relative to what is being accomplished elsewhere. This being the case, it is equally unlikely that any action would be directed toward correcting program deficiencies or directing changes that would improve program results.

Strategy/Planning

Recycling Strategy. As described in Chapter IV, Mintzberg and Quinn list five elements as being necessary for an effective strategy:

1. Clear objectives.

2. Maintain the initiative.

3. Efficient use of resources.

4. Flexibility.

5. Committed leadership.

Figure 22 summarizes the analysis of AFMC high-grade paper recycling program strategy. The program objectives are clear insofar as diversion is concerned, but unclear as to desired recycling program results, especially for individual materials. The initiative has been maintained over the years through revised goals, but those goals only pertained to diversion of material from landfill, not recycling. Resources have been efficiently used, but maximum results have not been achieved because effort was not applied to improving results for particular recyclables. High-grade paper is only recycled at an estimated rate of only 10 percent. This detracts from program efficiency and effectiveness. The program is flexible, but leadership is not completely committed. It has been decided that recycling will only be done to the extent that income meets or exceeds cost. Additional funding will not be provided beyond that point.

Any one or all of the five types of strategies described by Mintzburg in Chapter IV which he referred to as the five Ps could be applied as a strategy for conducting an Air Force recycling program. The concept of favorable positioning

Strategy Characteristics					
Clear Objectives	Maintain Initiative	Efficiency	Flexible	Committed Leadership	
X	X	X	X	X	Mintzberg and Quinn
O	O	O	X	O	EVALUATION OF RECYCLING STRATEGY KEY: FULLY APPLIED X PRESENT TO SOME DEGREE O NOT PRESENT -

Figure 23   Recycling Program Strategy Analysis Summary

could mean recycling those products that are readily available to the

organization, can be economically collected, are effective in reducing the volume

of landfill usage, and have a market demand. The concept of perspective is

applicable to the Air Force in that actions such as recycling which are in keeping

with the Air Force mission of service to the nation, whether strictly economically

profitable or not, can properly be a strategy upon which Air Force actions are

based. The concept of ploy could be applied in an area such as motivation

where it may be necessary to appeal to a variety of individual employee attitudes

and needs in order to favorably affect behavior and achieve program success.

The concept of pattern will always apply to Air Force actions since it refers to

what is actually being done. The concept of plan could, and most probably

should, apply to any Air Force program since, by definition, it means that conscious consideration has been given to the question of desired goals and objectives and how are they to be achieved.

Resource Commitment

The discussion in Chapter IV emphasizes the importance of assigning adequate manpower and allocating adequate resources if program success is to be achieved. The GPRA of 1993 specifically directs government agencies to provide the human, capital and other resources necessary to accomplish a program's planned goals and objectives. Collins stated that adequate resources are necessary for strategies to be successful.

At present, Air Force and command recycling programs have the minimum possible manpower assigned. Installation programs are limited to one person (appropriated fund) per base who performs the duties of program manager. Non-appropriated funds may be used to employee individuals to operate the recycling center, but as previously noted, only to the extent that program income meets or exceeds expenses. At both command and Air Force level, recycling program management is the responsibility of a single individual requiring only a few man-hours per week devoted to recycling program management. That is, recycling programs are only a minor portion of the assigned duties of those individuals.

The lack of staffing assigned specifically to recycling program and the many other duties that those individuals are responsible for would likely have at least three negative effects:

1. The recycling program will be a low priority for expenditure of the program manager's time, especially when considering the current lack of management emphasis on the program.

2. Performance of those tasks necessary to achieve optimum program results will likely will not be fully accomplished.

3. The implication that upper management does not consider the program to be of significance will be further strengthened.

Monitoring/Metrics.

Monitoring program performance through use of suitable metrics was emphasized in Chapter IV by all five cited references: the linkage study, ISO 14000, the GRPA of 1993, the APMH, and the BMP. The Air Force collects recycling data in the form of tons recycled and amount of overall waste diverted from landfill. This type of data is of value in measuring progress toward the 40 percent diversion goal, but as an indicator of individual material recycling program performance (high-grade paper, aluminum cans, etc.) it is of no help. A base might appear very successful by reporting high recycling tonnage and high overall percentage by mass, but may have recycled only a relatively small percent of many recyclable materials such as high-grade paper. Tons recycled and percent by weight can be a misleading statistic unless they are combined with some form of data showing percent recycled for individual categories of materials.

The Metrics Handbook. The following material is from an AFMC

publication, The Metrics Handbook, AFMC Pamphlet 90-102, 1 May 1995 (DAF,

1995a). This handbook is an update of the original published in 1991 by the Air

Force Systems Command. It provides a detailed description of what metrics are,

why metrics are necessary, and how they should be constructed and used. The

material below highlights portions of the Handbook pertinent to this study:

> Metrics are meaningful measures. For a measure to be meaningful, it must present data that encourages the right action. The data must be customer oriented, related to the product or service you provide, linked to the process generating that product or service, and supporting one or more organizational objectives. Metrics are also integral in measuring the success of our strategic plans. We put a plan in place to establish where we are and where we want to go, and then use metrics to measure our progress towards achieving those goals and objectives. Ultimately, metrics foster process understanding and motivate action to continually improve the way we do business. This is what sets metrics apart from measurement. Measurement does not necessarily result in process improvement. Effective metrics always will (DAF, 1995a:5).

The value of metrics is that they sustain the 'right' improvements. They

also help us to understand processes and their capabilities so that they can be

continually improved. They apply to any individual or any organization

responsible for a task, activity, system, or process (DAF, 1995a:5).

Metrics are measures that are being performed. Metrics communicate the

'health' of a process, they compare where the organization is now with where the

organization wants to go. If they are true metrics, they include a time dimension

and an improvement plan. A metric is a measurement made over time, which

communicates vital information about the quality of a process, activity, or

resource.

Several important characteristics of a good metric include:

1. It tells how well organizational goals and objectives are being met through processes and tasks.

2. It shows a trend, i.e., measures over time.

3. It is timely.

4. It drives the 'appropriate action.'

The Metric Handbook supports several program management elements: goals and objectives, performance measurement, reporting, and management emphasis.

As stated in Chapter IV, virtually all national and international programs use percent recycled as the standard metric for evaluating program success. However, Air Force bases do not collect the data necessary to determine the percentage of various materials recycled. To compute percentage recycled, it is necessary to know both the amount of each material purchased and the amount recycled. All Air Force base recycling units record data concerning the amount of each type of recyclable item they recycle during a given period of time, but they have no reliable means of determining amounts of each material purchased during an equal period of time.

As reported in previous chapters, authorities referenced in this study use "percent recycled" as the proper metric for evaluating the effectiveness of recycling programs. These include the EPA, BMP, AFPA, EMA, , ReThink Paper, NRDC, PNEB. and the AFRRRPG. The AFRRRPG specifically states that "recycling percentage" is used to judge the effectiveness of recycling efforts.

During the course of research for this study, no organizations outside of the Air Force was found to be using any metric to measure the progress of their recycling program other than percent recycled.

To summarize, the Air Force and AFMC do not use the metric nationally recognized as being correct for evaluating recycling program performance, nor do they currently have the capability to collect the data necessary to track progress through use of that metric.

Training

According to the five non-DoD/Air Force sources cited in Chapter IV, training is a critical to program success. Lund also emphasized the importance of training to the success of any recycling program. In Chapter II, the need for employee training concerning paper-saving methods and re-use of paper was discussed. Training should also include information concerning the value of recycling, use of recycling bins, organization progress toward goals, problems being experienced, and other information which will encourage and aid employees in supporting the program. No such training has been provided within AFMC for the purpose of improving program results, nor is any planned at this time. This lack of training not only prevents employees from participating in resource reduction and recycling efforts to the degree they otherwise might, it further adds to the perception that management has little concern for recycling program performance.

<u>Program Publicity</u>

As reported in Chapter IV, Lund states that education and publicity are the keys to successful recycling programs because success or failure depends on adoption of the program's goals by the entire organization. That is, employees must believe in the merit and value of the program if they are to give it the necessary support required for program success.

Publicity and training overlap to some degree since the very conduct of training significantly publicizes a program, but additional publicity activities other than training are important in providing employee motivating during program implementation and for maintaining that motivation in the long term. Unfortunately, publicity initiated by Air Staff and HQ AFMC in support of the recycling programs has been almost totally lacking. For example, neither Air Force nor AFMC has ever issued any posters in support of their recycling programs. During 1996, a poster was designed for a proposed publicity program which would involve the periodic design and distribution of new posters throughout the year to base recycling units to be used in support their base recycling programs. When the idea was presented to the chief of the AFMC Pollution Prevention branch, he directed that a survey of base recycling managers be made to determine their acceptance of the plan. When the recycling managers were informed that HQ AFMC was considering the distribution of a series of posters supporting the AFMC recycling program, the information was met with a uniformly positive response. Most individuals indicated that this was the first time in their memory that Command had shown

any interest in providing publicity support for their programs. A poster was subsequently prepared for publication; however, the chief of Pollution Prevention then objected to design aspects of the poster which included the use of text from a Japanese government institution. The chief of AFMC Pollution Prevention then directed the Command recycling program manager to develop revised text for the poster. When the program manager present the branch chief with a revised design containing new text, the branch chief again refused to approve the project, but instead directed that the proposed poster be sent to base-level recycling program managers to determine whether they were in favor of such a publicity campaign (if headquarters support were to be provided through purchase of the posters). Other pressing duties at the time prevented the Command program manager from conducting the publicity program acceptance survey among the base program managers and the proposal was put on hold (October 1996). More than two years have passed since that time and no poster has yet been distributed to the bases nor has any type of recycling program publicity campaign been initiated by HQ AFMC.

Along with the other crucial program management elements already lacking in the Air Force and AFMC recycling programs, the absence of a continuing publicity program virtually ensures that the program will go almost unnoticed and unsupported by employees. Programs of this type require periodic efforts to maintain employee interest and cooperation. Because it is not economically feasible for base level program offices to purchase minimum

production lots of posters or other publicity items, responsibility for detrimental

affects caused by this lack of publicity lies directly with HQ AFMC.

Management Priority

As noted in Chapter IV, management support and emphasis is critical to

the success of any programs. Part of this emphasis is shown by written policy

and proper selection of goals and metrics. Further emphasis is added when

progress is reported to management on a periodic basis and management

provides feedback as to whether or not that progress is satisfactory. Adequate

resource allocation is another indicator of management commitment. Ensuring

that employees are trained and that continuing program publicity is provided for

the program also show management commitment. That is, the existence of the

other eight program management elements shows management commitment.

Management Priority Characteristics								
Policy	Goals	Reporting	Strategy	Resources	Monitoring	Training	Publicity	
O	O	O	-	O	O	-	-	RECYCLING PROGRAM EVALUATION
								KEY: FULLY APPLIED X PRESENT TO SOME DEGREE O NOT PRESENT -

Figure 24   Management Priority Analysis Summary

Management Priority Analysis. Figure 24 depicts an analysis of AFMC

management priority as concerns the AFMC high-grade paper recycling program. As discussed in the individual sections above, six of these program management elements exist to some degree within the Air Force and AFMC recycling program, but they generally directed at diversion activities and relate to recycling only to the extent that recycling is a part of the diversion program. For all intents and purposes, training and publicity do not exist except for that provided by base recycling program managers on their own initiative. The results of management priority placed on diversion and not on recycling is that diversion results have been good while recycling results have been poor.

Funding Considerations

The HQ USAF/ILEV memorandum (cited in the first section of Chapter IV) which establishes the new 40 percent diversion goal, also clearly stated the Air Force solid waste management program financial support policy of funding programs only to the extent that cost is equal to or less than landfill or incineration. In Chapter II, various authorities were cited who believe that the future economy of our national and the world is going to be affected in a significant and adverse way if recycling of the earth's resources is not rapidly accelerated. Their view is that regardless of the economies of individual organizational recycling programs, the benefits to nations and the environment far exceed program costs. They state that governments should intervene in the economic processes such that recycled products can complete favorably with

virgin materials. They suggest that this can be done by applying some type of additional cost upon the use of virgin materials.

Despite being a tax-supported government agency, the Air Force has determined that this one aspect of its operations must operate at a profit, or at least break even. This is contrary to the funding philosophy of its other operations and well as the operations of federal, state, and local government activities in general. That is, government organizations by their very nature exist to provide services that have been determined to be beneficial to society. Funding is done through the process of tax collection, mot through a profit-generating process. If recycling programs are as important to the future welfare of society as so many authorities believe, why then is this one particular government-sponsored program expected to pay for itself rather than operate at the expense of general tax revenues? The fact that governments have not elected to assess a fee for use of virgin materials or otherwise incentivize recycling programs to does not mean that such programs are not beneficial to society, both economically and otherwise, but such failure to incentivize means that recycled materials often cannot compete in the marketplace with virgin materials. This, in turn, means that those social and economic benefits will not be achieved.

The perceived lack of adequate financial returns from current recycling programs may be appear to be a negative; however, this is the same view that managers might have expressed earlier in this century when hazardous materials were routinely disposed of into the environment rather than paying some

additional cost to dispose of them safety. At that time, improper disposal was clearly more economical than safe disposal, but we are now paying a very high cost to restore environments damaged by those practices. Even accounting for inflation, the eventual economic cost to society to correct for past waste disposal practices is counted in multiples of hundreds, or even thousands of times, what it would have cost to properly dispose of those materials properly in the past. Applying this same logic to recycling program policy means that present short-term economic benefits gained by not funding "unprofitable" recycling programs may require society to pay a much higher cost in the future.

AFMC Commander's Philosophy.

During the June 1998 Base Civil Engineer/Environmental Manager Conference, the AFMC Civil Engineer, Brigadier General Todd Stewart (1998), discussed the AFMC Commander's business management philosophy and policy. General Stewart emphasized the Commander's requirements for setting standards, determining minimum levels of acceptable performance, developing strategic plans, managing to the strategic plan, reporting progress in complying with the strategic plan, and conforming to the Government Performance and Results Act of 1993 (Public Law 103-62).

General Stewart's briefing focused on four requirements or needs:

1. The requirement to comply with the Government Performance and Results Act (GPRA) of 1993 which was outlined earlier in this chapter.

2. The need to set standards and specify measurement criteria.

3. The need to control performance by determining minimum and target levels of performance.

4. The need to compare actual performance against planned performance and managing to a strategic plan.

The AFMC Commander's business management philosophy and policy directly or indirectly addresses the following program management elements: policy, goals and objectives, strategic planning, management priority, metrics, reporting, and accountability/reporting. That is, the AFMC Commander has recognized these elements as being necessary for acceptable program performance. To the extent that these elements are not fully present in the AFMC recycling program, one might logically conclude that the program is not being managed in compliance with the Commander's desires.

Summary

Although the material for this study was drawn from diverse sources, most of the key references were specifically chosen not just because they contain support for the application of certain program management elements to high-grade paper recycling programs, but also because they are reference documents with which Air Force environmental staff members are very familiar and utilize on a daily basis. The Air Force policy concerning the requirement for recycling programs to pay for themselves appears to be the basic reason why principles of good management that are routinely applied to other programs throughout the Air Force are not present within recycling programs. The "pay for itself" philosophy

upon which the Air Force and AFMC recycling programs rests demonstrates that Air Force management either is not aware of or is not convinced by the arguments of those authorities who advocate the implementation of comprehensive recycling policies. Because the Air Force has chosen to limit the resources it devotes to recycling, it may find in the future that its current philosophy must change in response to socio-political, economic, or other pressures. With respect to high-grade paper specifically, lack of a more effective recycling program increases cost of Air Force operations and contributes to loss of national virgin forests.

VI. Conclusions and Recommendations

Conclusions

The Crux of the Problem—Funding Philosophy. Air Staff and Headquarters AFMC have evidently interpreted the "efficiency and cost effectiveness" wording in E.O. 13101 to mean that recycling programs are to be funded only to the extent that income meets or exceeds costs. This philosophy explains to a great extent why management of recycling of high-grade paper and other materials is deficient in the program management elements identified in this study.

Recycling Data. Air Force bases only collect data concerning the weight of materials recycled. Data concerning the amount of high-grade paper purchased is not collected, thus Air Force and AFMC are not collecting the data necessary to determine the effectiveness of their recycling programs, nor do they have the capability of doing so. This is partially because of the metrics selected by air Force, and partially because of a failure to see the need for obtaining procurement data for individual stock-numbered items when developing the IMPAC purchasing system with GSA. As a result, it is not possible to accurately know the amount of high-grade paper being purchased by any Air Force unit. This in turn makes it impossible to determine the percent of high-grade paper actually being recycled.

Program Management Elements. Chapter V described nine areas in which the Air Force and AFMC might more effectively manage their recycling

programs. Several of the more important of these would include development of a specific metric for high-grade paper recycling, training employees concerning ways of supporting the high-grade paper recycling program, and establishment of a continuing recycling program publicity campaign.

Recommendations

1. Funding Philosophy. The basic source of most deficiencies within Air Force and AFMC recycling programs is the current "pay for itself" philosophy, If Air Force and AFMC do not perceive recycling to be of sufficient importance to devote more attention, planning, and resources, it is unlikely that significant beneficial changes to the program will take place.

2. Data Collection. In order precisely calculate high-grade paper recycling rates, a means of collecting data concerning amounts of high-grade paper purchased by AFMC bases would need to be implemented. This information could then be used to accurately evaluate the performance of individual base high-grade paper recycling programs. However, lack of knowledge concerning the effectiveness of a program does not necessarily prevent the program from being managed in an effective manner. Much can still be done to improve program effectiveness by applying recognized best management practices, even though it might not be possible to measure the results accurately. Further, estimating recycling rates by survey facility waste containers may provide a sufficiently accurate estimate of program performance

at lesser cost than gathering purchase data and then correcting for paper going to and form base, being put into storage, etc.

3. <u>Program Management Elements</u>. The following changes to high-grade paper recycling program management should adopted Air Force-wide:

a. <u>Policies</u>. The Air Force should issue a recycling policy which supplements the DoD policy, but which includes specific goals that are stated in terms of percent recycled, includes metrics, requires reports on progress to upper management, requires adequate resource allocation, assigns accountability, requires necessary training and publicity, and requires management emphasis and support. Each Command should also issue individual policies supporting DoD and Air Force policies.

b. <u>Goals and Objectives</u>. Individual Air Force goals should be set for each of the materials being recycled, especially high-grade paper. The goals could be stair-stepped over a period of years such that continual motivation for improvement is provided. Criteria for the current Air Force Recycling Award should be modified to reflect and emphasize achievement of those goals.

c. <u>Management Emphasis and Support</u>. Lower-level management emphasis can significantly improve individual employee participation. Spot inspections of waste containers and outside containers can provide an indication of participation. Waste containers that obviously contain significant amounts of recyclables demonstrate to management the need to further emphasize the program within their organizations/facilities. Upper level management support

and emphasis is necessary to adequately motivate lower-level management and provide the impetus for program success.

d. Accountability. Accountability should accompany development of performance indicators. Commanders at all levels should be made aware that goal achievement is expected unless rational justification exists for any shortfall. This philosophy should extend to the lowest levels. Each employee in each facility must understand that compliance with recycling procedures is expected and that disregard for the program will bring consequences. Contractor compliance should also be emphasized where applicable.

e. Program Strategy. Air Force and the individual commands should devise cohesive strategies for accomplishment of recycling goal and objectives. These strategies should be clear, proactive, flexible, emphasize efficiency, and be committed to by Air Force and command leadership.

f. Resource Allocation. Air Force should put more resources into the recycling program, especially manpower at command and Air Force level. The present minimum resource allocation is a direct indication to those below of how little emphasis the Air Force and the commands place on the recycling program. Greater emphasis and increased expenditure of time are needed. Rather than being a minor effort within the solid waste disposal program, management of the recycling program should reside with one or more individuals at each level whose time is devoted to that program only. Both program accountability and emphasis would be greatly improved by such a change. When recycling is just one of many programs that an individual is responsible for,

it is not likely to receive the attention or emphasis it deserves, especially if the program is not a high-profile item with upper management.

g. <u>Performance Measurement/Metrics</u>. Performance indicators should be established at Air Staff level for recyclable materials being procured by the Air Force. These performance indicators should be consistent with the goals established in recommendation 3.a. above and should become increasingly stringent in future years. They should also comply with the recommendation in AFMC pamphlet 90-102, <u>The Metrics Handbook</u>. That is, be meaningful, show progress toward goals, be understandable, show trends, be unambiguous, be efficient, be timely, and drive the appropriate action.

h. <u>Reporting</u>. Recycling program performance indicators or metrics should be included in upper management briefings within individual commands and at Air Staff. Upper management cannot provide necessary oversight and make timely decisions if they are not provided with appropriate data concerning program status.

i. <u>Employee Education and Training</u>. Employees should receive periodic training concerning goals of the high-grade paper recycling program and means by which those goals are to be achieved.

j. <u>Program Publicity</u>. A coherent, continuing publicity campaign should be implemented for the high-grade paper recycling program.

<u>Further Research</u>

The subject of practical data collection methods should be researched further with detailed recommendations being made as to how this could best be done. Two possibilities were noted in this study, but other even more practical methods might exist. This would be helpful to program improvement because awareness of program status can act as a motivator for continued employee support as well as providing needed information to upper management.

The evaluations in Chapter V were a matter of subjective judgement by the author. A broader based, and possibly more reliable, evaluation of the AFMC High-Grade Recycling Program could be obtained by surveying the various AFMC base recycling program managers for their opinions concerning the extent to which the nine PMEs are present in the AFMC program.

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<u>Vita</u>

Mr. Rodger L. Carter was born on 2 November 1937 in Toledo, Ohio. He graduated from Clay High School, Oregon, Ohio, in 1955. He received a BBA and an MBA in Industrial Management from the University of Toledo, Toledo, Ohio, in 1961 and 1966. He received a Specialist degree in Administration in 1978 and a Master of Science in Safety in 1979 from Central Missouri State University, Warrensburg, Missouri. In the Spring of 1993, Mr. Carter entered the Graduate Engineering and Environmental Management program in the School of Engineering, Air Force Institute of Technology, as a part-time student. Mr. Carter is a retired Air Force Officer and is now an Air Force civilian employee assigned to Headquarters Air Force Materiel Command Civil Engineering Environmental Management Division, Wright-Patterson Air Force Base, Ohio. Mr. Carter has been employed in the environmental career field for six years. Prior to that, he held safety positions with the Veterans Administration and the Air Force. He is past chairman of the Miami Valley Federal Safety Council and past president of the Kittyhawk chapter of the American Society of Safety Engineers (ASSE). In 1991 he was selected by the ASSE as Safety Professional of the Year for Region VII, a seven-state area. His professional certifications include Certified Safety Professional (CSP), Registered Environmental Manager (REM), and Certified Hazard Control Manager (CHCM). He is married to Major Su P. Carter, USAF, retired. Permanent address: 2292 Walnut Court, Xenia, Ohio 45385