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IMPLEMENTATION OF RESOURCE RECOVERY GUIDELINES AT FORT MEADE, F--ETC(U)
JUL 79 B A DONAHUE, D D KRAYBILL, G MITCHELL

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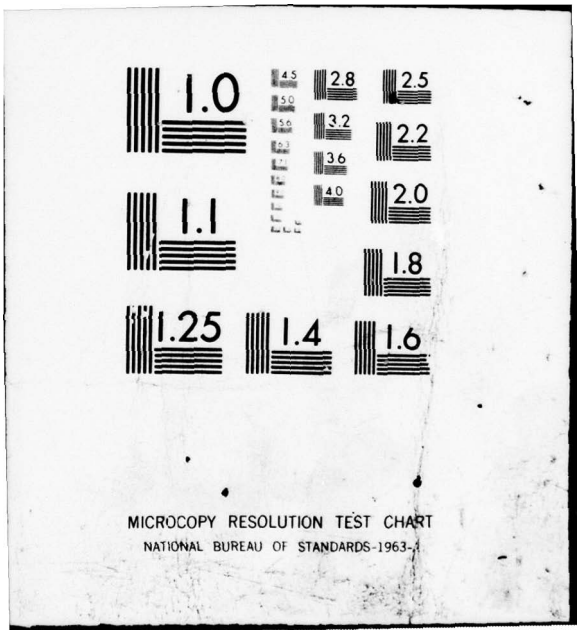
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TECHNICAL REPORT N-71
June 1979

IMPLEMENTATION OF RESOURCE RECOVERY GUIDELINES AT FORT MEADE, FORT LEWIS, AND FORT SILL

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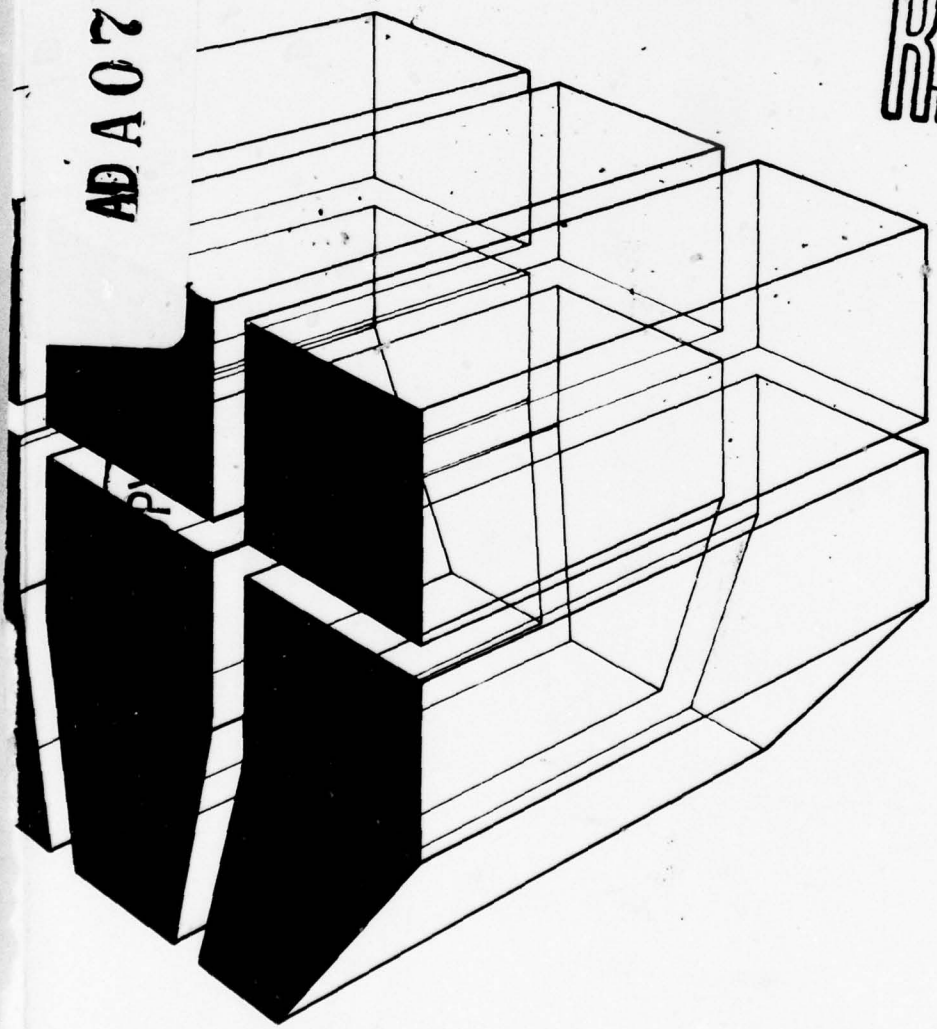

by
B. Donahue
D. Kraybill
G. Mitchell
M. Smith
P. Deminco

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report documents the attempt to implement requirements of the "Source Separation for Materials Recovery Guidelines" at Fort Meade, MD. These guidelines, one of six U.S. Environmental Protection Agency Solid Waste Management Guidelines, are primarily concerned with the source separation of high-grade paper, newspaper, and corrugated paper. The information obtained from the implementation at Fort Meade was compared with voluntary recycling programs at Fort Sill, OK, and Fort Lewis, WA.

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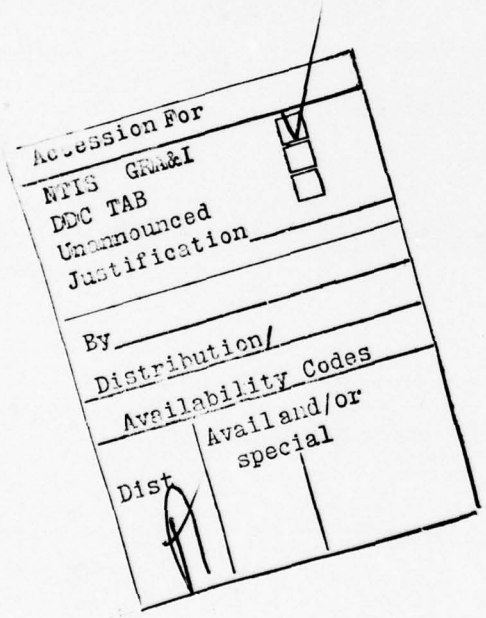
Extensive economic analysis at Fort Meade indicated that "full" implementation of the program for cardboard at points of high generation was deemed economically feasible. The investigations at Fort Sill and Fort Lewis indicated that two key items are essential for successfully implementing voluntary resource recovery programs at installations: (1) interest in and understanding of the program by installation personnel at a meaningful level, and (2) public interest and motivation, maintained through an innovative incentive program. Another reason the programs at Forts Sill and Lewis were successful was because the labor was voluntary.



EXECUTIVE SUMMARY

The solid waste collection and disposal practices used at Fort Meade, MD, a typical Army installation, follow a standard pattern. The Facilities Engineer (FE) oversees refuse collection for various operational light industrial and office activities, while private contractors service family housing areas. All collected solid waste is delivered to a sanitary landfill located on the installation. The refuse composition is typical of military/domestic wastes generated by Army TRADOC and FORSCOM installations.

This study implemented resource recovery practices outlined in 40 CFR 246, "Source Separation for Materials Recovery Guidelines," and evaluated their economic feasibility in order to develop standardized procedures for implementing the Guidelines at typical DOD installations. Factors used when evaluating resource recovery included marketing requirements, quantity/quality of waste material, location of material, storage availability, additional equipment and personnel required for resource recovery, and refuse disposal savings. Specific cost analysis factors include the following:

1. Market analysis. Examination of the local market for high-grade corrugated and newsprint indicated that there was a competitive local market interested in participating in the program.

2. Generation rate. The total amount of high-grade paper, cardboard, and newspaper generated was estimated from actual purchasing information where available. The amount available for recycling was then determined by using participation rates typical of similar voluntary efforts at resource recovery.

3. Cost of resource recovery. Costs of personnel and equipment required for collection, storage, and delivery of material to the commercial dealer were estimated, using local equipment and wage costs. (The cost for recycling was determined independently of refuse collection as though there would be no decrease in refuse collection costs.)

4. Refuse disposal credit. A direct cost savings was calculated for recyclable material that was diverted from the sanitary landfill. The amount of cost savings was based on the actual costs reported for operating the landfill.

5. Revenues derived from the sale of materials. The revenues are based on local commercial market value quotations for the various grades of paper generated at the time of the trial implementation. The revenues were decreased by 20 percent because of the Defense Property Disposal (DPDO) fee for sales administration.

The final decision on whether resource recovery was economically viable was based on the following equation:

Net savings/cost ($/mo.) = revenue ($/mo.) + disposal savings ($/mo.)

- recycling cost ($/mo.)

Using this formula, it was determined that for Fort Meade, recycling cardboard from the various points of high cardboard generation was economical, while recycling newsprint and high-grade paper was not.

When it became apparent that full implementation of 40 CFR 246 would not be possible at Fort Meade, it was decided to evaluate the Fort Sill, OK, and the Fort Lewis, WA, voluntary recycling programs to determine the factors contributing to their apparent success.

Recycling at Fort Lewis has good command support and diverts approximately 6 percent of the post's waste material from the sanitary landfill. The most striking feature about the recycling operations at Fort Lewis is the amount of hand sorting and contaminant removal necessary to produce a marketable product. Corrugated, newsprint, high-grade paper, metal cans, computer tab cards, mixed scrap paper and glass are delivered to the recycling center by DFAE equipment, unloaded, and hand-processed by military personnel especially assigned to this operation.

The program economics developed by Fort Lewis were not complete. The economics analysis considered military labor as voluntary, did not account for equipment rental, and did not take credit for benefits derived from sanitary landfill savings. A rigorous cost analysis on the existing program would include all costs, as well as all savings.

Fort Sill's recycling program is unique because it operates on a competitive and highly successful basis via the RAW deal (RECYCLE AND WIN) program. Military units bring glass, cans, newsprint, corrugated paper, mixed paper, and computer tab cards to the recycling center where the material is weighed. The units delivering the material are awarded points, and the unit which earns the greatest number of points during each fiscal quarter wins an improvement project of its choice having a value up to $5000. Materials are processed largely by hand in a central recycling point by three temporary military personnel, two temporary civilians, and one part-time student aide.

Program economics, which are incomplete, include charges for civilian labor, maintenance of equipment, and rental of mobile equipment; however, they exclude charges for military labor, utilities, and maintenance of buildings used for recycling.

Recycling participation at Fort Sill is highly successful and has high command support. The program's uniqueness and high degree of success have attracted the attention of the national news media. It is the

only known incentive program in the military with the purpose of encouraging recycling.

The investigations at Fort Sill and Fort Lewis indicated that two key items are essential for successfully implementing voluntary resource recovery programs at installations: (1) interest in and understanding of the program by installation personnel at a meaningful level, and (2) public interest and motivation, maintained through an innovative incentive program.

FOREWORD

This study was performed for the Directorate of Military Programs, Office of the Chief of Engineers (OCE), under Project 4A762720A896, "Environmental Quality for Construction and Operation of Military Facilities"; Task 02, "Pollution Abatement Systems"; Work Unit 007, "Solid Waste Management, Recycle, and Resource Recovery for Military Facilities." The applicable QCR is 1.03.006(4). The OCE Technical Monitor is Walter Medding, DAEN-MPO-U.

The report was prepared in part by SCS Engineers under contract DACA 8-877-R-0007 for the Environmental Division (EN), U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, IL. The CERL Principal Investigator was Mr. B. Donahue. Dr. R. K. Jain is Chief of EN.

COL J. E. Hays is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

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1 INTRODUCTION

Background

In 1965, Congress enacted the Solid Waste Disposal Act (PL 89-222), the first Federal legislation dealing with the environmental effects of solid waste disposal. The Federal program under this Act was largely a system of grants which stressed state and local responsibility.

By 1970, the far-reaching implications of disposing of valuable resource and waste products were widely recognized. Congress then amended the 1965 Act with the Resource Recovery Act of 1970 (PL-512). This law officially recognized the potential economic benefits of recovering a portion of solid wastes.

Although state and local officials have primary responsibility for the management of solid wastes, a provision was written into Section 211 that Federal agencies "shall insure compliance with the guidelines recommended under Section 209 and the purposes of this Act."

Executive Order 11752, issued on 17 December 1973, strengthened this requirement. It states in part, that "Heads of Federal Agencies shall insure that all facilities under their jurisdiction are designed, constructed, managed, operated and maintained so as to conform to guidelines for solid waste recovery, collection, storage, separation and disposal systems issued by the Administrator (EPA) pursuant to the Solid Waste Disposal Act, as amended."

In implementing the 1970 Act, the Administrator of the U.S. Environmental Protection Agency (EPA) issued six Solid Waste Management Guidelines, one of which is "Source Separation for Materials Recovery Guidelines" (hereafter referred to as the Guidelines). The Guidelines, which became effective on 24 May 1976, contained required and recommended procedures for recovering resources from waste materials for all Federal facilities. These procedures are generally mandatory for facilities and installations generating large amounts of waste, and where the costs of operating such programs are expected to be reasonable.

The Guidelines are primarily concerned with the source separation of high-grade paper, newspaper, and corrugated paper. "Source separation" is a system whereby waste materials are separated and accumulated at their point of generation for recycling. To implement the Guidelines at Army installations, the Office of the Chief of Engineers must draft resource recovery guidance that Army Facilities Engineers can use to conform to resource separation and recycling provisions.

Objective

The objectives of this study were (1) to implement the requirements of "Source Separation for Materials Recovery Guidelines" at Fort Meade, MD, (2) to evaluate their economic feasibility, and (3) to compare this field experience with the voluntary recycling programs at Fort Sill, OK, and Fort Lewis, WA.

Approach

Implementation of the Guidelines at Fort Meade was attempted according to the following plan:

1. The paper generation potential on the post was estimated

2. A survey was conducted to gain information about recycling markets for paper

3. Based on the information about paper generation and recycling markets, a decision on further evaluation of the implementation plan was made

4. A recycling project team was organized

5. Detailed paper generation data were gathered

6. Potential recycling systems were designed

7. A cost analysis was conducted for these systems

8. The decision about whether to implement or not implement the best system was made

9. The voluntary recycling programs at Fort Sill, OK, and Fort Lewis, WA, were evaluated to determine the factors which facilitated their success.

Mode of Technology Transfer

This information will be used as input for drafting resource guidelines for Chapter 4, AR 420-47, Facilities Engineering -- Solid Waste Management.

2 IMPLEMENTATION OF SELECTED SOURCE SEPARATION TECHNIQUES AT FORT MEADE, MARYLAND

Background

Fort Meade is a FORSCOM installation located in Anne Arundel County, MD, between Washington, DC and Baltimore. The installation houses more tenants than any other CONUS post.

A site visit indicated that Fort Meade is a fairly typical Army installation. The solid waste collection, disposal, and recycling procedures as they existed are described in the following paragraphs.

Custodial Service

All custodial services required by industrial and office facilities on the base are contracted to private firms.

Trash Collection and Disposal

The Facilities Engineer Office deploys its own trucks and personnel to collect solid waste from the various operational, industrial, and office activities around the installation. The National Security Agency (NSA), Fort Meade's principal tenant, is currently serviced for all its unclassified waste by a private collection firm contracted by the General Services Administration (GSA). However, NSA is seeking to augment this pickup arrangement with FE services through an Inter Service Support Agreement. Family housing areas are serviced by private contractors. Presently, two firms handle the collecting duties, which involve backyard pickup (noncurbside). The Chief of Buildings and Grounds at the FE office advocates a switch to the less expensive curbside pickup, but the Post Commander opposes it because of anticipated scavenger problems.

All solid waste collected by the FE and by contractors is delivered to a sanitary landfill located on the installation. The total amount of solid waste generated annually on the base is approximately 12,400 tons (11 160 mt).

Fort Meade presently uses the trench method of landfilling, but is planning to adopt the area fill method. The planned landfill site has a projected life of 20 years per layer, indicating that landfill space will be in plentiful supply for several decades.

A post-wide recycling program was begun at Fort Meade 5 or 6 years ago, but has since lost momentum. Currently, only a carryover of the program remains, as some of the more resource-conscious employees continue to segregate mixed paper and tab cards for pickup by the PDO.

Sources of Waste

Office High-Grade. The major office buildings that produce high-grade waste include the following: Post Headquarters, 1st Army Headquarters, DIO Supply Division, MISO, and the logistics office of USAINTA.

Most of these offices made considerable use of data via computer printouts. This was especially true of DIO Supply Division and MISO, where computer tab cards were also used in sizeable quantities. Printout paper and tab cards constitute two particularly high grades of wastepaper when segregated from other office high-grade wastepaper. DIO and MISO office personnel stated that these two types of waste are segregated and set out periodically for pickup and subsequent recovery.

It was concluded both from observation and discussions with management personnel that segregation of white paper would not be a problem. It would simply be an extension of the current practice of segregating classified and unclassified materials. Disposal of classified wastes appears to be a major problem, however, and including this type of waste in the wastepaper recovery program would not be feasible. Furthermore, the small quantities of classified waste generated by USAINTA (250 lb/week [114 kg/week]) would hardly justify implementing a special recovery system.

Corrugated. The Commissary and Commissary Annex were examined as potential sources of recoverable corrugated cardboard. The two branches have combined gross sales of $1.8 million per month. Both stores currently segregate corrugated waste and store it in compactors. The compactor at the main store is hauled to the landfill and emptied every other day, while the same-sized compactor at the Annex is emptied once each week.

Currently, the main Commissary has one cardboard box baler which is installed, but not operational. The Annex has a similar baler which is not fully installed. With all three balers in operation, the commissary could bale all its corrugated waste. The bales could be hauled periodically to the PDO for indoor storage and subsequent sale. Together, the two stores represent a large, steady source of clean, saleable corrugated waste, with their combined gross sales indicating a generation of approximately 37 tons (34 mt) of solid waste each week, of which 68 percent, or 25 tons (23 mt), consists of corrugated containers. The meatpacking area of the main commissary, however, produces substantial amounts of corrugated waste soaked with meat juices; this waste would be a serious contaminant in the clean corrugated bales, and should therefore be disposed of with the other solid waste.

The Post Exchange (PX) was also identified as a steady source of clean corrugated waste. The PX currently segregates its corrugated waste and bales it in a large baler (800- to 1000-lb [360 to 450 kg]

bales) located on bales are backhauled in delivery trucks to a regional Army Air Force Exchange Service (AAFES) distribution center in Philadelphia; the corrugated waste is presumably sold there in large lots. The PX also has a separate garden shop and toyland center from which no corrugated is recovered. Since AAFES is a self-supporting operation, revenues from such sales remain within the Exchange Service. Therefore, the PX's recovery system, including the use of its baler, is autonomous, and would remain separate from the corrugated recovery operations carried out by other post activities such as the Commissary.

DIO Maintenance was initially seen as a source of substantial corrugated waste, since it orders and receives numerous shipments in corrugated cartons. However, the shipments are subsequently dispersed in their original packaging to other facilities around the installation.

Newspaper Waste. The family housing areas were visited to evaluate present waste disposal operations, as well as the operational feasibility of collecting separated used newspapers. The housing is a mix of complexes totaling 3278 family units. The housing is comprised of single-family dwellings, townhouses, and duplex and garden apartments.

Private contractors handle the regular waste collection for the single-family and townhouse units. Currently, two companies are contracted to provide back-yard pickup services three times each week. The FE supplies in-house pickup for the bulk waste containers used by the duplex and garden units. Both the private contractors and the FE dump the solid waste in the on-post sanitary landfill.

PDO

The PDO is the final link for any installation recycling program. Most storage of reclaimed paper and all negotiations for sale of the material must be handled by DSA. As such, PDO procedures were observed and its physical storage and handling capabilities examined.

The PDO had substantial indoor storage space, enough for 75 tons (68 mt) of reclaimed paper. The forklift in its warehouse is adequate for moving pallets or bales. In addition, the warehouse contains an old vertical baler which is used to bale recovered paper.

The PDO currently accumulates and sells both mixed paper (comprised of newspaper, magazines, office high-grade, and substantial amounts of computer printout) and tab cards. The paper is separated by a few of the activities at the installation. The paper is collected loose, in bags or boxes, by FE and the PDO. The mixed paper is then baled by the PDO; both the mixed paper and the tabcards are accumulated for a few months and sold in lots. Enough material for about two trailer loads is normally accumulated prior to sale to obtain the best possible price for the lot. Two lots were sold in the first 6 months of 1976 at quite high prices.

Administration

Effective administration will be required to oversee source separation activities established at Fort Meade. Regardless of the alternative(s) chosen for implementation, the Post program should be viewed and administered as an extension of existing solid waste management practices, not as a separate "recycling program." The directive for program implementation should be issued from the Post Commander's office. Responsibility for its administration should lie with the DFAE, who already oversees other solid waste management programs at the Post. The administrative procedures should include overseeing the collection, publicity, and general management programs in the participating activities.

One person (approximately GS-12 level) in the DFAE should be designated as Program Coordinator. This person will have general authority to administer the overall program and coordinate with the PDO and others on the Post regarding the program's operation. The costs of varying amounts of the Program Coordinator's time will be included in each alternative developed.

Publicity

Adequate and proper publicity is the key to attaining and maintaining the levels of participation necessary to make any source separation program cost-effective and meaningful in terms of amount of waste diverted. General types of publicity media applicable to most feasible alternatives are discussed below. They are intended to spur interest in the program in general, and to provide individuals involved in specific aspects of the program with an overview of the total effort. Specific publicity programs are outlined in the discussion of each recoverable material.

Hotline (Information and Troubleshooting Telephone Line). During implementation, many questions may arise concerning different aspects of the source separation program. To facilitate response and to insure a high degree of effective participation, an information/troubleshooting line should be made available.

The hotline should be answered by a DFAE secretary who should be able to answer most questions. Other questions and problem situations would be handled by the Program Coordinator. The Hotline can fit into most routine office procedures with little or no disruption, particularly after program implementation.

Radio and Television. If feasible, a local radio station or stations should be contacted to determine the possibility of a brief prerecorded radio spot presentation (5 to 10 minutes, question and answer type) describing the recycling effort at Fort Meade, and its history, application, and significance.

Public events announcements are regularly available on most radio stations at no cost. The Post should use this service to remind persons that the program is in effect and to provide the Hotline number. This service should be continued regularly to inform new Post personnel and remind permanent personnel about the program.

Reporters from area television stations should be notified when the recycling program is initiated at Fort Meade. A filed report of the program would be appropriate for the early evening local news.

Movie Theater Slide. A slide could be prepared promoting the Post's recycling efforts, which could be presented between showings of scheduled movies at the Post theater. This approach would be best suited for newsprint and high-grade recovery programs, which involve relatively large numbers of people.

Van Displays. A traveling van display could be set up at main recreation centers and at the PX buildings on-Post. While space limitations at the main commissary would preclude the van display, it could be set up at the commissary annex. The display should include a video cassette-TV, and should be kept very simple. The main purpose of the video cassette should be to capture the interest of the audience. The Hotline number should be included in the program. Leaflets reiterating the main topic and the Hotline number should be included with the cassette presentation.

School Curriculum. A unit of instruction on recycling incorporated into the curriculum of the elementary school(s) serving Fort Meade could be beneficial to the post's programs and other recycling efforts. The children could be involved in projects which could tie in with the post's program, i.e., newspaper collection, bundling papers. A general education program at the elementary level will have the added benefit of educating the parents. The Public Affairs Office could outline the curriculum and coordinate with local school administrators regarding its development and implementation.

Newspapers. A detailed article should be published in Soundoff, one of the post's newspapers, about 3 weeks before the program is implemented, and another large (front-page) article should be printed about 1 week before implementation. Weekly references thereafter should be boxed entries and should list pickup schedules and the Hotline number. Another detailed article should be written 2 months after implementation, noting recovery rate and savings.

The Unit Commander, a publication for tenant commanders, is primarily concerned with single-theme topics. This would be a particularly effective way to reach the various tenant commanders who will be concerned with high-grade recycling.

The Bulletin is a daily publication already used by the Boy Scouts to advertise newsprint collection. It is well-suited for publicizing relatively infrequent events and therefore is not particularly appropriate for ongoing programs.

High Grades

Introduction. High-grade wastepaper is generated in approximately 71 on-post buildings housing administrative personnel. In the development of feasible alternatives for paper recovery, these buildings were grouped into three categories: (1) Category I -- more than 100 employees; (2) Category II -- 25 to 100 employees; and (3) Category III -- fewer than 25 employees.

Three alternatives involving combinations of these categories were developed, described, and analyzed: (1) Category I buildings only, (2) Category I and II buildings, and (3) Category I, II, and III buildings.

Markets. Dealers contacted during the market survey indicated that high-grade paper could be handled in any one of the following three ways:

1. Bales - 800- to 1000-lb (363.6 to 454.5 kg) size

2. "Gaylord" boxes - pallet-mounted corrugated boxes holding 500 to 600 lb (225 to 270 kg) of paper

3. Trays - wheeled hampers holding 400 to 500 lb (180 to 225 kg) of paper.

Prices quoted depended on the storage method. Baled paper commands the highest price -- $60 to $80 per ton (66 to 90 per mt). Paper in "Gaylords" or trays commands $32 to $70 per ton (35 to 75 per mt). Baled paper can be shipped directly from the dealer to the mill, but with other approaches, the dealer must bale it. Some mills will accept "Gaylords," but transportation costs are higher than for bales.

Dealers prefer trailer-load quantities of 15,000 to 18,000 lb (6800 to 8200 kg). Trailers could be placed at one pickup location at a cost of $200 per month; this cost would be included in the quoted price. Most dealers indicated that mixed loads of newsprint, corrugated materials, and high-grade paper are acceptable, but will entail a marginal penalty. Additionally, most dealers were concerned that a source-separated high-grade paper would actually only be marketable as a mixed ledger. Most quotes for the high grades were very conservative, reflecting the dealers' feeling that the flow would really only be a mixed grade.

General Approach

System designs for high-grade paper recovery programs begin with the market; i.e., how will the market accept the material (bale, loose, etc.), and what can the market provide (balers, spot trailers, bale jacks)? After considering these factors, the following general approach was considered most feasible for all building categories:

1. The market (dealer) should place a trailer at the concrete loading dock near the main commissary

2. The market should provide trays on an exchange basis

3. Building custodians should collect source-separated paper from the central containers and put it into the trays

4. DFAE personnel should store trays in the buildings until pickup time, using a stake-crane truck. Empty trays should be dropped off as full ones are collected

5. Full trays should be taken to the loading dock and wheeled into the trailer.

This approach minimizes the post's handling requirements at the various sources and eliminates the need for a central processing facility with a baler and operator. However, slightly less revenue per ton will be realized than with other approaches, because the market is providing trays, trailer and transportation, and baling.

Baling is possible at Fort Meade, but it could be difficult. The DPDO baling operation has little excess capacity except the existing mixed paper recovery program, due to lack of personnel. Unused balers at the commissary could be used for high-grade paper; however, a facility (building) would have to be allocated (or even constructed) for this activity. Additionally, an operator, forklift or bale jack, and other equipment would have to be procured. Baling would produce the highest return to the Post, but would require additional labor; in addition, it might not be preferred by dealers unless the level of contaminants was consistently low. Thus, baling should be considered only as a last resort.

"Gaylords" are also a viable alternative for Fort Meade. They require less handling than bales and could be used for storage within buildings. However, once filled, a forklift, pallet jacks, and even loading docks are required to move them. This will be a problem at Fort Meade if a remote trailer storage site is used. Forklifts and pallet jacks will be difficult to schedule or store at the site.

Administration and Publicity

The program coordinator (GS-12 level) must play an active role in both the implementation of the project and the resultant on-going activities associated with any high-grade recovery program. The general duties primarily emphasize coordination and publicity. EPA studies have estimated the time requirements to administer the implementation and continuation of high-grade paper separation programs as follows:[1]

Implementation: 10 person-hours per 100 employees

Continuation: 16 person-minutes per month per 100 employees

The above administrative time requirements for the program coordinator were taken into account and included in the cost analyses.

EPA also implemented program publicity requirements on the basis of implementation and continuation of high-grade paper program. Initial publicity and educational materials were estimated at $7 per 100 employees. The cost of on-going publicity (posters, notices) was estimated to be $1 per month per 100 employees. These costs were also included in the cost analyses.

The key activity leading to the success of a high-grade paper recovery program is the initial education provided to each employee at program initiation. This education is best provided through a brief (20-minute) presentation which includes a slide show about how the system operates, a question and answer period, and the distribution of desk-top containers. Other general steps publicizing program implementation at Fort Meade were as follows:

1. The Post Commander issued a letter describing the project and requesting cooperation on all levels to each tenant commander whose building was included in the program.

2. Each tenant commander issued a memorandum to the appropriate division heads, announcing the program and containing a copy of the post commander's letter.

3. Each division head notified employees of the program. Notification included date of department assembly, designated areas, and schedules of attendance.

4. The division notification was reinforced by posting a reference to the post commander's letter in a conspicuous place, along with a reminder of the upcoming assembly.

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[1] Office Paper Recovery: An Implementation Manual (U.S. Environmental Protection Agency, 1977).

5. Employees attended education sessions and saw a slide presentation explaining the forthcoming effort, followed by a brief (10-minute) question and answer period. Liaison representatives were established from each division to answer questions. Employees were made aware of the general Hotline number.

6. The program was initiated.

7. Approximately 3 weeks after implementation, a follow-up memorandum was sent from each tenant commander to division personnel to encourage participation.

8. Posters were placed in conspicuous areas adjacent to central containers to remind personnel to separate high-grade materials.

9. Quarterly reminders were issued.

The effort involved in carrying all other publicity approaches except the van display and the school curriculum program was included in the time allocated to the program coordinator.

Category I Buildings

General

A minimum of 17,840 lb (8000 kg) of waste is estimated to be generated from the 10 Category I buildings each week. This represents approximately 3.7 percent of the total weekly generation at the post. A projected high-grade recovery rate of 5500 lb (2500 kg) per week represents 31 percent of the Category I generation and 2 percent of the total post waste generation.

Only seven of the 10 Category I buildings should be included in a high-grade paper recovery program:

1. 2234 - Finance and Accounting
2. 4215 - Multi-Tenant Administration
3. 4216 - Multi-Tenant Administration
4. 4217 - Post Headquarters
5. 4550 - 1st Army Headquarters
6. 4411 - Multi-Tenant Administration
7. 4432 - Military Personnel Office

The three USAINTA buildings (4552, 4553, and 4554) should not be included because of their security requirements. This will reduce the potential flow from 5500 lb (2500 kg) per week to 3500 lb (1600 kg) per week. The other buildings are all large administrative activities and are accessible by truck; some have loading docks or entrance ramps that could be used to service paper storage areas.

Administration and Publicity

The seven buildings house 1520 administrative employees. The costs for administering the program for these buildings, using the EPA estimates for administration and publicity, is shown below. The program coordinator was assumed to be a GS-12 at $20,442, plus 32 percent for fringe benefits.

Publicity

Implementation	
$7/100 employees x 1,520 employees	$106
Continuation	
$1/100 employees x 1,520 employees	$15/mo

Administration

Implementation	
10 hrs/100 employees x 1,520 employees x $12.97/hr	$1,971
Continuation	
16 min/100 employees/mo x 1,520 employees x $12.97/hr	$53/mo

System Requirements

Separate high-grade paper would be taken from the desk-top containers by each office worker and placed in a conveniently located central container. Central containers having a capacity of approximately 1-1/2 cu ft (42 ℓ) would be placed in office complexes in each building for every 15 to 20 administrative employees. These containers are constructed of either fiberboard or plastic. It would be the responsibility of the cleaning contractor to empty the containers into canvas bags and take them to a central storage area within the building.

Canvas bags having capacities of 50 to 60 lb (20 to 25 kg) would be used at each building to collect paper from central containers and store it until pickup by the collection crew. These bags are the only handling option, since most buildings have no elevators or heavy material handling equipment. All materials must be hand-carried. These bags would remain at each building. Full bags would be stored at a central

location, placed in the trays or the collection truck, and returned empty to the storage area. Locating storage space in each building for bags is easier than for trays or pallets.

It is important that a scheduled collection system be developed which insures that the material will not over-accumulate at any one point. One custodian in each building should be assigned paper collection as part of his/her duties. This will expedite the collection process and reduce the potential for contamination.

Twice each week, DFAE personnel collect the paper. The crew moves the full canvas bags to the truck where the bags are emptied into trays. Empty bags are returned to the building. After collecting from all buildings, the collection crew would haul the full trays to the loading dock and wheel them into the trailer. Figure 1 illustrates the proposed collection and storage system.

Table 1 indicates the program requirements and estimated monthly costs that would be incurred for equipment and personnel to collect and store high-grade paper generated from Category I buildings. Personnel requirements were based on the number of hours currently spent collecting mixed paper at Fort Meade, plus estimates from EPA office paper recovery program cost estimates. Sixteen DFAE manhours per week will be required to collect paper from buildings and move it to a central storage point. In addition, 16 manhours per week of intra-building collection time will be required by the custodial contractor. The hourly rates for each, plus the cost of using the stake-body truck were provided by DFAE personnel.

All equipment requirements were estimated based on recovery programs implemented in civilian office buildings. The estimated canvas bag requirement was based on providing a total bag capacity of 1750 lb (800 kg) (50 lb each [23 kg]), assuming two 4-hour collections/week (a total of 3500 lb/wk [1600 kg] generated from the seven Category I buildings). Seven trays having a capacity of 500 lb (230 kg) each are required to store 3500 lb/wk (1600 kg/wk) of paper. Eight additional trays would be provided on an exchange basis. All equipment costs were amortized as indicated in Table 1 to develop a monthly cost estimate.

Category I and II Buildings

General

Seven Category I buildings and 18 Category II buildings housing a total of 2321 employees will be included in this group. The Category II buildings consist of the next smaller administrative function. These are mostly individual buildings housing only administrative functions. Most are contract cleaned but have limited storage and material handling capabilities. They generally share tenant facilities with neighboring

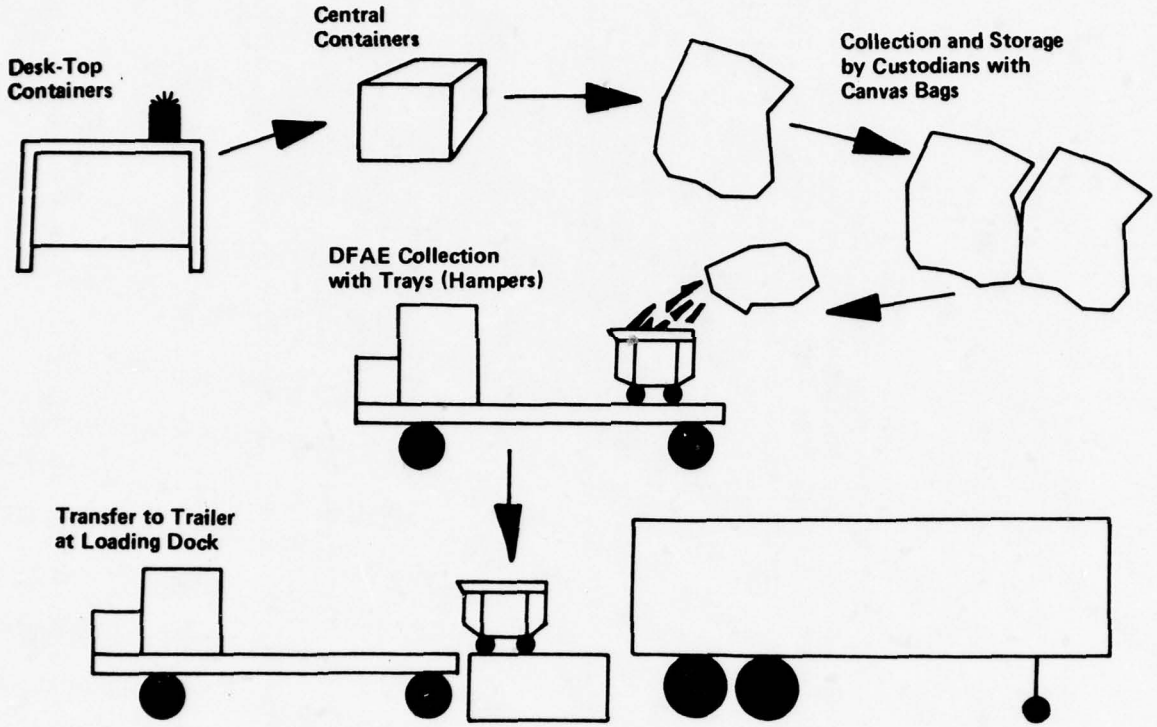

Figure 1. High-grade paper recovery from Category I buildings.

Table 1

Category I - High-grade Paper Recovery Program Requirements and Estimated Cost*

Item	Amount	Cost/Unit	Total Cost	Life (yrs)	Cost/ Month
1) Equipment					
A) Desk-Top Containers	1,520	$ 1	$1,520	8	$ 16
B) Central Containers	100	5	500	8	5
C) Canvas Bags	35	25	875	2	36
D) Recycling Posters	100	1	100	2	4
E) Trays	15	**	-	-	-
F) Stake Body Truck	32 hrs/ month	3.84/hr.	122.88	-	123
G) Publicity	N/A	N/A	15	-	15
Subtotal Equipment					199
2) Personnel					
A) DFAE Collection (Inter-building)	64 hrs/ month	10.50/hr.	672	-	672
B) Contract Collection (Intra-building)	64 hrs/ month	3.80/hr.	243	-	243
C) Administration	4+ hrs/ month	12.97/hr.	53	-	53
Subtotal Labor					968
Total Equipment and Labor					$1,167

* Does not include publicity and administration costs for implementing the program.
** To be provided by the sales contractor.

buildings. They also tend to be located away from the central core of the Post.

Category II buildings generate approximately 6200 lb (3000 kg) of waste per week representing approximately 1 percent of the total post generation. An estimated 1400 lb (640 kg) of high-grade paper per week could be recovered representing approximately 1 percent of the total post generation. An estimated 1400 lb of high-grade paper per week could be recovered from this category; 23 percent of the flow from these buildings and 0.3 percent of the entire Post waste stream.

The total projected high-grade paper recovery from Category I and II buildings is 4900 lb (2200 kg) per week. This amounts to approximately 1.3 percent of the entire post's waste stream.

Administration and Publicity

Essentially the same approaches for publicity and administration that were outlined for Category I buildings will be applicable to the combination of Categories I and II. Anticipated costs are:

Publicity

Implementation	
$7/100 employees x 2,320 employees	$162
Continuation	
$1/100 employees/mo x 2,230 employees	$23/mo

Administration

Implementation	
10 hrs/100 employees x 2,230 employees x $12.97/hr	$3,009
Continuation	
16 min/100 employees/mo x 2,320 employees x $12.97/hr	$80/mo

System Requirements

Category I buildings would still be collected twice per week by the DFAE crew; however, the smaller quantities generated in Category II buildings require collection only once each week. Figure 2 portrays the proposed system.

The 25 buildings housing a total of 2321 employees will require 2321 desk-top containers and 155 central containers and recycling posters. Assuming that there will be weekly collection from Category II buildings, a total of 28 canvas bags, each having a capacity of 50 lb

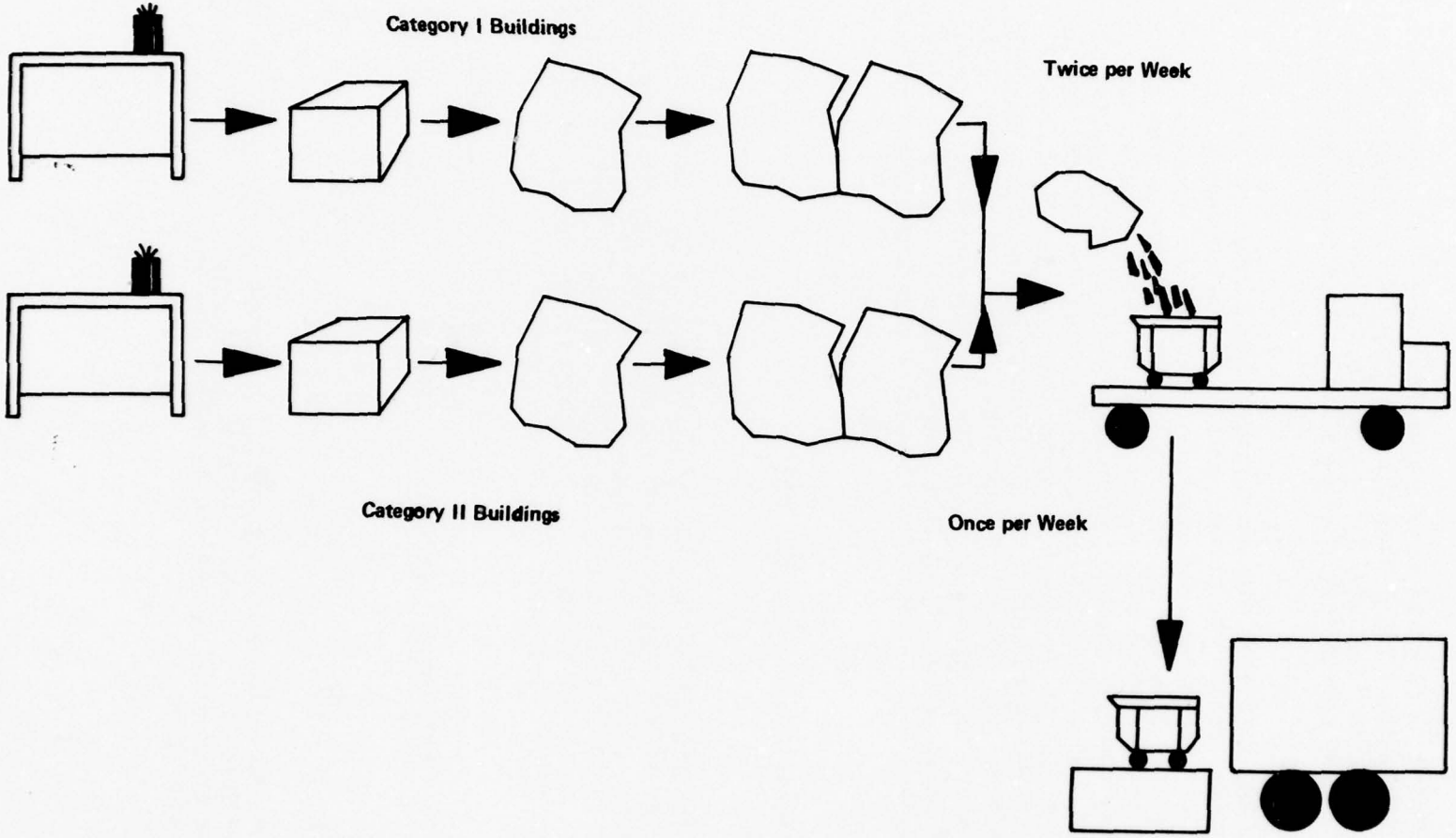

Figure 2. High-grade paper recovery from Category I and II buildings.

(23 kg) will be required (1400 lb/wk [640 kg] total generation ÷ 50 lb = 28.) Thus, a total of 63 bags will be required for Category I and II buildings. Ten trays will be required to store 4900 lb (2200 kg) of paper for two categories, plus an additional 10 for exchange during pickup.

Approximately 68 minutes per week (34 minutes per stop) are estimated to be required to collect paper from each Category I building (two collections per week). Category II buildings are expected to take slightly less time due to their smaller size. Once a week collection (30 minutes per stop) will reduce servicing requirements, but will subsequently increase storage requirements. Assuming 30 minutes per stop and once-a-week collection, the total monthly collection time for Category II buildings is 36 hours, and is 68 hours for both Categories I and II. Intra-building collection is expected to require 4 hours/100 employees/month for Category I and II buildings. This yields 93 hours per month, which will probably be provided by the custodial contractor. Some of this collection may be augmented by military labor in certain buildings. Table 2 summarizes the system requirements and estimated costs.

Category I, II, and III Buildings

General

This alternative involves virtually all administrative buildings at Fort Meade with the exception of the USAINTA complex--Buildings 4552, 4553, 4554. The inclusion of Category II and III buildings in a paper recovery program greatly increases the number of buildings involved. However, number of personnel participating, and therefore the amount of paper recovered, increases slowly, as shown below:

Category	No. Buildings	No. Personnel	Est. Paper Recovery (lb/wk)	(kg/wk)	Recovered Paper As Percent of Post's Waste
I	7	1,520	3,500	1600	1.0
I&II	25	2,321	4,900	2200	1.3
I,II,&III	69	2,803	6,200	2800	1.5

The 44 buildings in Category III house 482 personnel. Most Category III buildings are small isolated structures. Most of these buildings are cleaned and maintained by military or civilian personnel in the tenant activities.

Table 2

Category I and II High-Grade Paper Recovery Program Requirements and Estimated Costs*

Item	Amount	Cost/Unit	Total Cost	Life (yrs)	Cost/ Month
1) Equipment					
A) Desk-Top Containers	2,321	$ 1	$2,321	8	$ 24
B) Central Containers	155	5	775	8	97
C) Canvas Bags	63	25	1,575	2	66
D) Recycling Posters	155	1	155	2	6
E) Trays	20	**	-	-	-
F) Stake Body Truck	68 hrs/ month	3.84/hr	261	-	261
G) Publicity	N/A	N/A	23	-	23
Subtotal Equipment					477
2) Personnel					
A) DFAE Inter-building Collection	136 hrs/ month	10.50/hr.	1,428	-	1,428
B) Contract Intra-building Collection	93 hrs/ month	3.80/hr.	353	-	353
C) Administration	6+ hrs/ month	12.97/hr.	80	-	80
Subtotal Labor					1,861
Total Equipment and Labor					$2,338

* Does not include publicity and administration costs for implementing the program.
** To be provided by the sales contractor.

Administration and Publicity

The same approaches will be used for these functions as outlined for Category I buildings. The associated costs are tabulated below:

Publicity

Implementation	
$7/100 employees x 2803 employees	$196
Continuation	
$1/100 employees/mo x 2803 employees	$28/mo

Administration

Implementation	
10 hrs/100 employees x 2803 employees x $12.97/hr	$3,635
Continuation	
16 min/100 employees/mo x 2803 employees x $12.94/hr	$97/mo

Systems Requirements

All Category III buildings will require only one central container. Canvas storage bags will be used to minimize building servicing requirements. The central container would be dumped into the bag by tenant employees and stored in a closet or other approopriate area awaiting biweekly collection by the DFAE.

DFAE will perform inter-building collection and storage on a scheduled basis. However, in smaller outlying buildings housing either military or civilian activities, accumulated paper would be carried by employees to a larger nearby building. This will help reduce DFAE collection requirements. It is expected that at least 25 percent of the smallest Category III buildings could pool collection activities in this manner. Figure 3 portrays the projected system.

A total of 2803 desk-top containers and 187 central containers and recycling posters will be required for all Category I, II, and III buildings. Assuming semiweekly collections from Category I buildings, weekly collection from Category II buildings, and biweekly collection from Category III buildings, 115 canvas bags will be required as shown in the following:

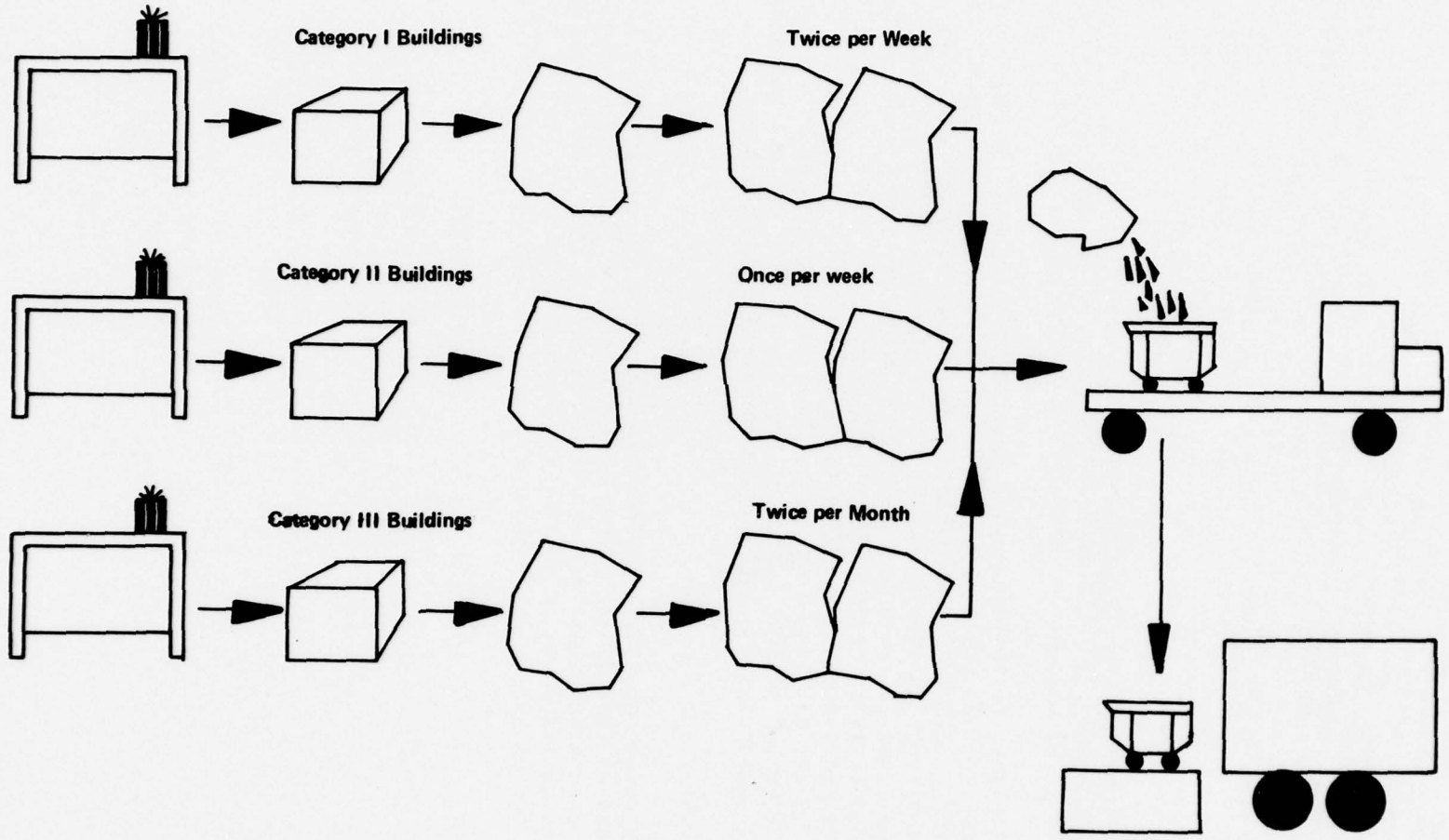

Figure 3. High-grade paper recovery from category I, II, and III buildings.

Category	Exp. Monthly Recovery lb (kg)	Collections Per Month Per Building	Storage Required lb (kg)	Bags Required (50-lb capacity)
I	14,000 (6400)	8	1,750 (800)	35
II	5,600 (2500)	4	1,400 (640)	28
III	5,200 (2400)	2	2,600 (1200)	52
			Total	115

Assuming an average weekly pickup of 6200 lb (2800 kg) of high-grade wastepaper, a total of 25 trays (500-lb [230 kg] capacity) will be required -- 50 percent for storage and 50 percent for exchange.

Category III buildings will require approximately 33 hours per month to service, assuming biweekly collections and 44 buildings each requiring 30 minutes of collection time. This also includes a 25 percent collection stop reduction due to pooling. Adding that to the Category I and II collection time of 68 hours per month yields a total monthly collection requirement of 101 hours. There will be no intra-building requirements in the Category III buildings, since most of the buildings are maintained by the custodial contractor and serviced directly from the central container area by the DFAE collection force. Table 3 summarizes the system requirements and monthly costs.

Corrugated

Introduction. Waste corrugated materials are generated at 17 locations at Fort Meade. These buildings were divided into three categories according to estimated generation rates; the total generation rate was estimated to be 54 tons (50 mt) per week (more than 22 percent of the post's entire waste generation). The categories are as follows:

Category	Buildings
I	Main Exchange Main Commissary Commissary Annex
II	Four Branch Exchanges Meade Service Station
III	Three Branch Exchanges Clothing Store Self-Servicing Store DIO Supply Warehouse Self-Help Facility Cold Storage DFAE Supply

Table 3

Category I, II, and III High-grade Paper Recovery Program Requirements and Estimated Costs*

Item	Amount	Cost/Unit	Total Cost	Life (yrs)	Cost/ Month
1) Equipment					
A) Desk-Top Containers	2,803	$ 1	$2,803	8	$ 29
B) Central Containers	187	5	935	8	10
C) Canvas Bags	115	25	2,875	2	120
D) Recycling Posters	187	1	187	2	8
E) Trays	25	**	-	-	-
F) Stake Body Truck	101 hrs/ month	3.84/hr.	390	-	390
G) Publicity	N/A	N/A	23		28
Subtotal Equipment					585
2) Personnel					
A) DFAE Inter-building Collection	200 hrs/ month	10.50/hr.	2,121	-	2,121
B) Contract Intra-building Collection	93 hrs/ month	3.80/hr.	353	-	353
C) Administration	7+4 hrs/ month	12.97/hr.	97	-	97
Subtotal Labor					2,571
Total Equipment and Labor					$3,156

* Does not include publicity and administration costs for implementing the program.
** To be provided by the sales contractor.

In developing alternative approaches, all Category III sources were eliminated from consideration because of extremely low generation rates, seasonality, or contamination problems.

Markets. Marketing options for corrugated include selling the material baled or in stationary compactors. One price for baled materials (800- to 1000-lb [350 to 450 kg] size) was quoted to be $25 to $35 per ton ($27.50 to $38.50 per mt) in trailer-load quantities FOB at Fort Meade. Mixed loads (corrugated, high-grade, and newsprint) were acceptable.

Corrugated materials could be stored in stationary compactors. Using this approach, the compactor bodies would have to be hauled to the dealer's yard where the contents are unloaded. Most dealers would accept corrugated in this manner, but the material must have less than 5 percent contaminants. No dealer could service the compactors on the post, so DFAE personnel or a contractor would have to haul the container. Prices ranged from $10 to $20 per ton ($11 to $22 per mt) at the dealer's yard. The distance of dealers for corrugated materials from Fort Meade ranged from 15 to 25 miles (24.1 to 40.2 km) (one-way).

General Approach

Method of Sale

Baling and delivery in stationary compactor bodies are both viable approaches to handling corrugated materials at Fort Meade. Thus, alternatives using both approaches were developed. The PX currently bales corrugated materials, and alternatives were developed that both include and exclude PX participation.

Administration and Publicity

Virtually no existing corrugated recovery program has been evaluated to the extent needed to estimate costs for administration and publicity. Estimates have been made for these functions in future programs at Marine Corps Air Station, Cherry Point, NC, and Marine Corps Base, Camp Lejeune, NC. Corrugated generation rates and sources at Camp Lejeune are similar to those at Fort Meade. Therefore, these estimates will be used.

As with high-grade paper, implementing a corrugated materials recovery program will require more of the program coordinator's efforts and publicity than continuing it. Administering the implementation of a program is estimated to require 24 person-hours for each major source, e.g., commissary, commissary annex, main exchange, major warehouse, and 16 person-hours for each minor source, e.g., branch exchange, self-service supply outlet, small warehouse. Publicity during implementation is estimated to cost $20 per building regardless of size, primarily for posters. The uniform cost is due to the fact that waste corrugated

materials are normally generated in one area of a building and leave that building through no more than two exits.

Administration of an on-going program should require only about 4 hours of the program coordinator's time each month for up to 12 sources of corrugated materials. Publicity will primarily be replacement of posters and periodic newspaper articles relating the success of the program. Costs should not exceed $25 per month for a program including all Category I and II buildings at Fort Meade.

The main thrust of the corrugated materials publicity and education program will be as follows:

1. A memo will be issued by the post commander to each chief of operations at the commissaries and, possibly, the PXs involved.

2. A management directive will be issued by each chief of operations to the supervisors of storeroom and dock operations.

3. Each supervisor will inform his/her staff of the correct procedures for separation. A copy of the previous directive memo will be posted on the bulletin board adjacent to the time clock.

4. The compactors or balers will be located in areas convenient for their use, and away from refuse dumpsters. (However, the refuse dumpsters should not be located at too great a distance from the compactors or balers, or nonsegregation of wastes will occur.)

5. Posters with simple graphics will be placed upon the doors leading to the dock area, and on the compactors themselves to remind employees of the correct separation procedures.

6. One dock area/storeroom person per shift will be assigned to run the spot checks and determine that separation requirements are met. This person will be given the Hotline number, in case questions arise.

Category I Buildings -- Baling

It is estimated that using the current baling operation at the PX plus balers at both commissary locations could recover 124 tons (112.7 mt) of corrugated per month. The primary consideration for this alternative is the extreme lack of storage space for completed bales at the Main Commissary. Assuming 800-lb (350-kg) bales, the following weekly generation rate is estimated, based on a 6-day week at all locations:

Main Commissary	38 bales
Commissary Annex	7 bales
Main Exchange	33 bales
	78 bales/week

Administration and Publicity. Based on the guidelines presented above, the estimated costs for these functions are:

Publicity:

Implementation $20/building x 3 buildings	$60
Continuation	$15/mo

Administration:

Implementation 72 person-hours x $12.97/hr	$934
Continuation 4 person-hours/mo x $12.97/hr	$52/mo

System Requirements. The overall system would include:

1. Continuation of the baling operation at the Main Exchange

2. Baling at two locations at the Main Commissary

3. Baling at the Commissary Annex

4. Daily pickup of bales by DFAE crew with transfer to a trailer spotted at the loading dock.

The Main Exchange and the Commissary Annex appear to have adequate space for storing their bales. However, the Main Commissary loading dock will have to be modified. Covered extensions to each dock will have to be provided to store the bales, which will further congest a crowded area. However, with approximately 90 percent of the commissary's waste leaving as baled corrugated, the two stationary compactors at the Main Exchange could be removed and their space made available for deliveries and other dock usage. Similarly, the stationary compactor at the Commissary Annex could be excessed and removed. At both locations, conventional dumpster containers would be provided for other solid waste.

Costs for constructing these dock extensions which were used in the cost analysis of this alternative were estimated as follows:

Construction	$1,600
Engineering	400
Total	$2,000

The cost of removing the compactors was not estimated. If sold as excess property, the purchaser could be required to remove the units. Smoothing the concrete pads and future construction of new docks is the Post's option.

At the commissary locations, stock clerks and other personnel would load corrugated waste into the baler and would activate the compaction mechanism when adequate quantities were accumulated. When a bale was completed, one person would band the bale and move it with a bale jack to the adjacent dock storage area. Exchange personnel estimated that 10 minutes are required to band and move a bale. This estimate was applied to the commissaries.

A DFAE crew (two persons and the stake/crane truck) would pick up bales from each location daily. An estimated average of 2 hours per day would be required to collect the 12 bales (approximately) generated, haul them to the trailer, and unload the bales using a pallet jack. Twice a week, the crew would load the bales into the trailer by fork-lift. This is estimated to require 4 hours each week. Figure 4 illustrates the system, and Table 4 lists its probable costs.

Commissaries -- Stationary Compactors

Another alternative, which would involve only the two commissaries, would use the existing stationary compactors only for corrugated, with dumpsters provided for other wastes. The two locations should recover approximately 72 tons (65.4 mt) per month.

When full, the three compactor bodies would be emptied (estimated average total of four pulls per week), hauled to the dealer's yard, emptied, and returned. This is fewer than half of the present number of pulls. However, since the compactors will not contain putrescible material, there will be no sanitation reason for having more frequent pulls.

It is assumed that the PX will continue baling its own corrugated and <u>not</u> participate in this program.

<u>Administration and Publicity</u>. Administrative and publicity procedures will be similar to the previous alternatives, but scaled down because there will be fewer sources.

Publicity:

Implementation $20/building x 2 buildings	$40
Continuation	$10/mo

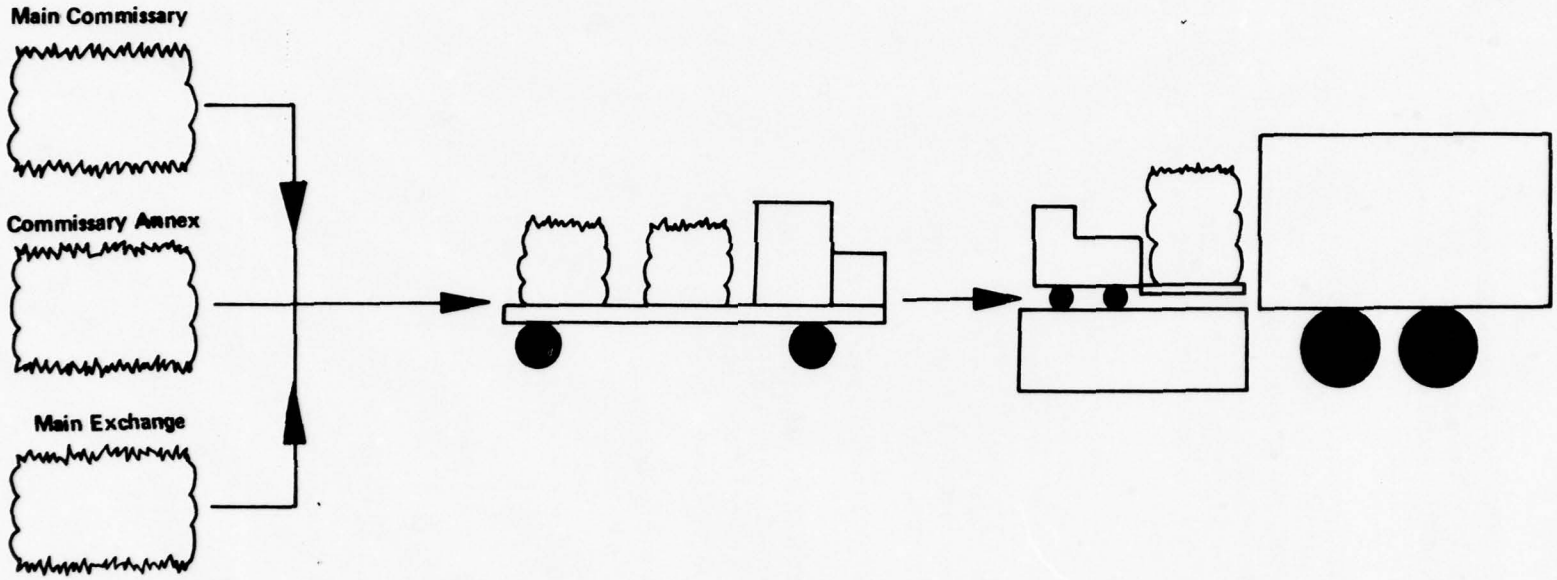

Figure 4. Corrugated recovery from Category I buildings.

Table 4

Category I - Baled Corrugated Recovery Program Requirements and Estimated Costs*

Item	Amount	Cost/Unit	Total Cost	Life (yrs)	Cost/ Month
1) Equipment					
A) Commissary Dock Modifications	2	$2,000	$ 4,000	20	$ 17
B) Balers	4	5,000 (installed)	20,000	8	208
C) Bale Jacks	5	500	2,500	5	42
D) Baler Maintenance	N/A	100/hr/ machine	--	-	33
E) Stake Body Truck	48 hrs/month	3.84/hr	--	-	184
F) Forklift	16 hrs/month	.90/hr	--	-	14
G) Publicity	N/A	N/A	--	-	15
Subtotal Equipment					$ 513
2) Personnel					
A) On-Site Baling	52 hrs/month	5/hr**	--	-	260
B) DFAE Collection	96 hrs/month	10.50/hr	--	-	1,008
C) Forklift Operation	32 hrs/month	10.50/hr	--	-	336
D) Administration	4 hrs/month	12.97/hr	--	-	52
Subtotal Personnel					1,656
Total Equipment and Personnel					$2,169

* Does not include administration and publicity for program implementation.
** Estimated.

Administration:

Implementation	
48 person-hours x $12.97/hr	$623
Continuation	
3 person-hours/mo x $12.97/hr	$39/mo

System Requirements. Commissary personnel would separate corrugated material by source and place it in the existing stationary compactors. Other wastes would be placed in dumpster containers serviced by DFAE crews. No incremental labor increases are foreseen at the commissary since virtually all waste is now corrugated and compacted. The three balers at the commissaries should be considered excess equipment and either removed, transferred, or sold.

The full compactors would be pulled by Dinosaur trucks operated by DFAE crews. Each pull and round trip to the dealer's yard would require approximately 2 hours for the truck and one-person crew. Figure 5 illustrates the mechanics of this system. Associated costs are listed in Table 5.

Categories I and II -- Central Processing

An approach for baling corrugated wastes from buildings in Categories I and II would involve having waste delivered to a central processing facility where it would be baled and stored prior to shipment. Approximately 128 tons (116.4 mt) of corrugated would be recovered each month from the three Category I buildings and the five Category II sources.

Corrugated wastes would be stored at their sources as follows:

1. Main Commissary and Commissary Annex - compactors as described in the alternative for baling.

2. Main Exchange - compactor. Baling would be discontinued and all other wastes put into 8-cu-yd (6 m^3) dumpster containers. More containers and/or more frequent service may have to be provided for general wastes.

3. Category II Buildings - 8-cu-yd dumpster containers specially marked for corrugated waste only. Other wastes are stored in 8-cu-yd (6 m^3) containers.

When necessary, the compactors would be pulled by a Dinosaur truck operated by a DFAE crew and delivered to a central processing center where the corrugated wastes would be unloaded. The dumpster containers would be serviced by a DFAE crew using a front-loading, compactor truck which would deliver corrugated wastes to the processing center. Figure 6 depicts the system.

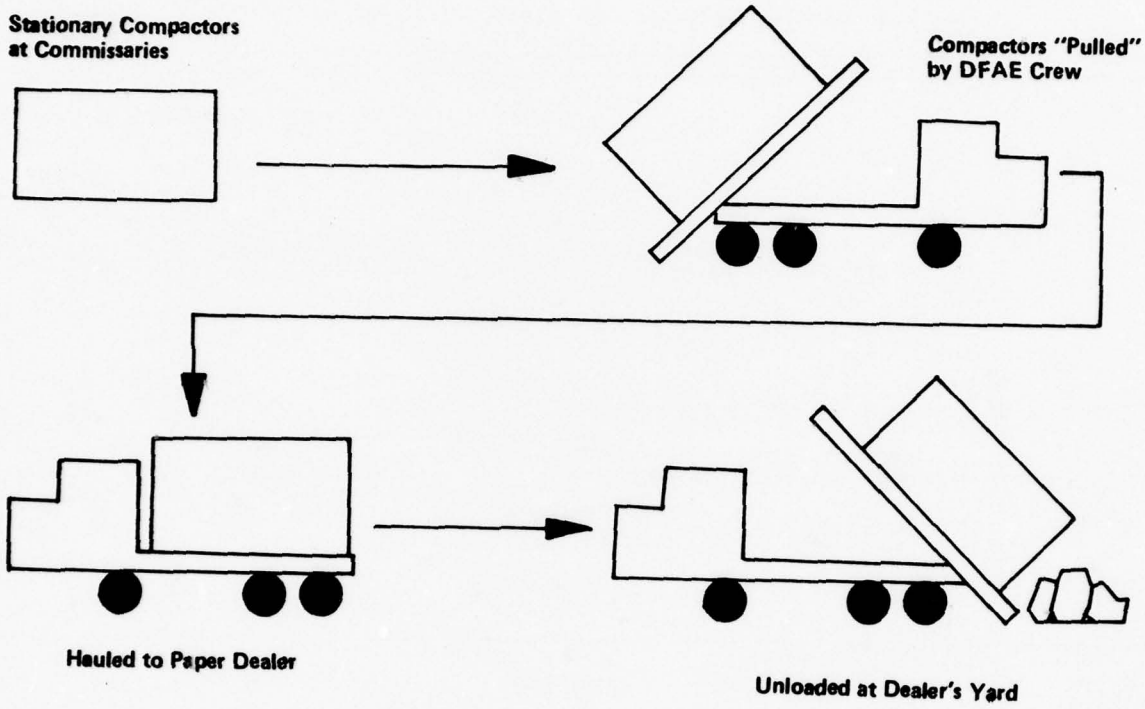

Figure 5. Corrugated recovery using stationary compactors.

Table 5

Commissary Stationary Compactors Corrugated Recovery Requirements and Estimated Costs*

Item	Amount	Cost/Unit	Total Cost	Life (yrs)	Cost/ Month
1) Equipment					
A) Compactors	3	$12,000	$36,000	8	$ 375
B) Compactor O & M	3	500/yr	--	-	125
C) Dinosaur Trucks	32 hrs/month	4.86/hr	--	-	156
D) Publicity	N/A	N/A	N/A	-	10
Subtotal Equipment					$ 666
2) Personnel					
A) DFAE Collection Labor	32 hrs/month	10.50/hr	336	-	336
B) Administration	3 hrs/month	12.97/hr	--	-	39
Subtotal Personnel					$ 375
Total Equipment and Personnel (DFAE)					$1,041

* Does not include publicity and administration costs for program implementation.

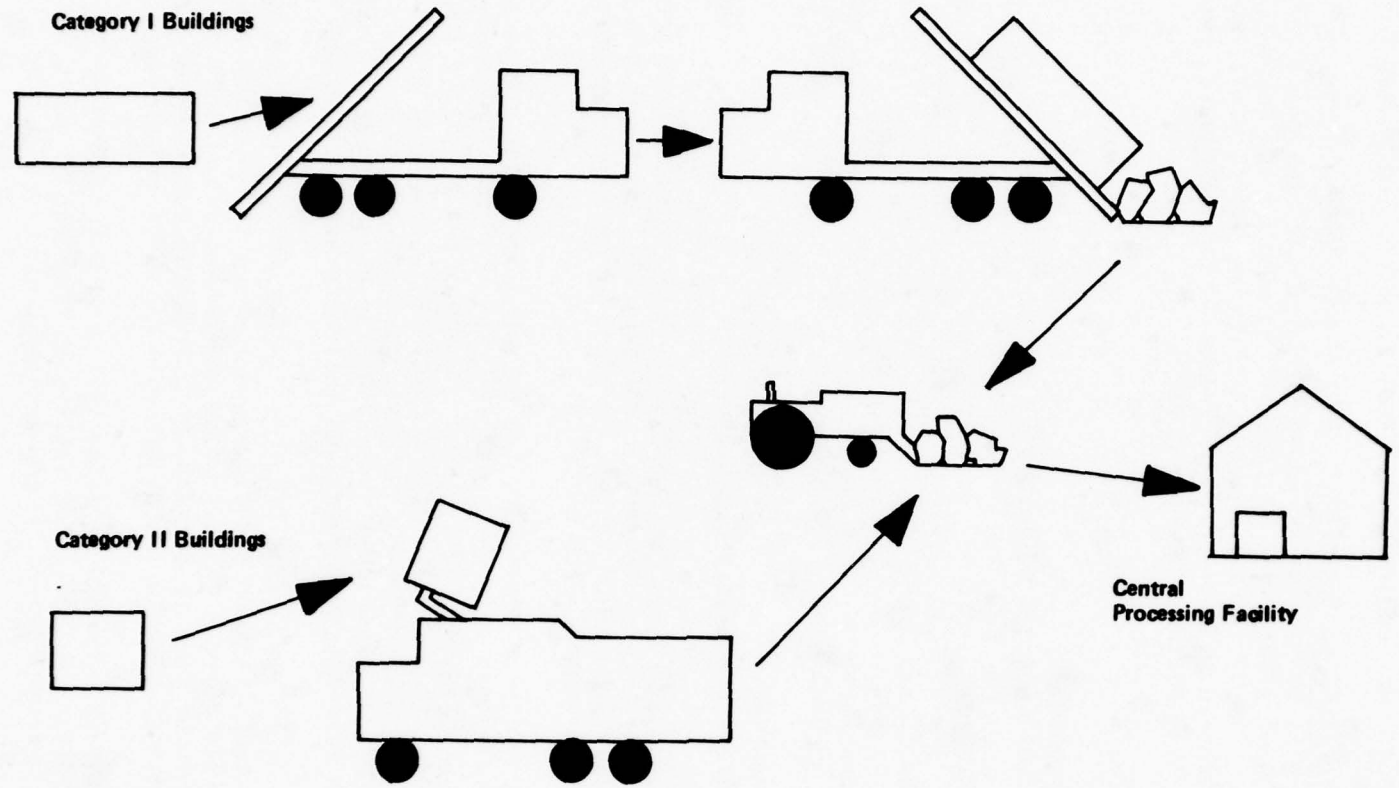

Figure 6. Corrugated recovery using a central processing facility.

The material would be baled and stored at the processing center. When a trailer-load was accumulated, the dealer would be contacted to pick it up; DFAE personnel would load the trailer with a forklift. This alternative does not require that a trailer be spotted at the Post.

Administration and Publicity. Administration and publicity for this program will be similar to those used for the previous alternatives; additional effort will be required because of the added Category II buildings. Similarly, the central processing facility will require more administrative effort. Administration of the continuing program is estimated to be 8 person-hours per month.

Publicity:

Implementation $20/building x 8 buildings	$160
Continuation	$25/mo

Administration:

Implementation 162 person-hours x $12.97/hr	$2,101
Continuation 8 person-hours/mo x $12.97/hr	$104/mo

System Requirements. No incremental labor increases are necessary at the Category I or II buildings. Employees will be asked only to separate corrugated from other wastes and place it in an appropriately marked container outside each building.

The compactors at commissary and exchange locations are associated with the recovery program, and costs incurred for their replacement and maintenance are charged accordingly. Likewise, the estimated ten 8-cu-yd (6 m^3) dumpster containers at the Category II buildings are charged to the program. However, the dumpster containers placed at the commissary, exchange, and Category II buildings for general refuse are not associated with corrugated recovery and therefore are not charged.

Collection of corrugated from the compactors requires an estimated 32 hours per month (six to eight pulls per week) for both the truck and driver. Additionally, a front-loading packer and driver will be required 4 hours per week to service the corrugated dumpsters at the Category II buildings. The 10 containers will be serviced semi-weekly.

Buildings 2027 and 829 were identified by Post personnel as the only two buildings available for setting up the central processing facility. Neither are located in the central industrial area of the Post,

and neither have loading docks; however, it appears that either could be appropriately modified. Needed modifications include:

1. Construction of loading dock

2. Paving and fencing two 50- x 100-ft (15 x 30 m) areas adjacent to the building for receipt and storage of materials

3. Providing utility service

4. Installation of restroom

5. Provision of heating and ventilation systems

6. Installation of the baler

Items of equipment needed to operate the facility include:

1. Down-stroke, pit-type baler, 2000 lb/hr (910 kg/hr)

2. Forklift

3. Farm tractor with grading blade

A full-time, two-person crew would operate the processing facility. Recovered paper would be delivered and unloaded at the fenced receiving area. The crew would use a small farm-type tractor (LP-gas-powered) with a front blade to push materials into the baler. Bales would be removed by forklift for storage inside the building; storage space outside the building would be used as necessary. A forklift would be used to load trucks or train cars. Table 6 lists requirements and costs associated with this alternative.

Newsprint

Approximately 13 tons (12 mt) of newsprint are delivered to Fort Meade each week, and an unknown number of newspapers are mailed directly to personnel at the Post. Overall, newsprint accounts for approximately 5 percent of the Post's waste stream.

The Boy Scouts are operating a newsprint collection system which is attaining varying degrees of success; recovery rates range from 3 to 42 percent of the available newsprint.

Markets. Newsprint can be marketed either baled or loose. The price for a trailer-load of baled material ranges from $20 to $34 per ton ($22 to $34/mt). Loose paper (not baled) normally has to be delivered to the dealer. Prices quoted for this arrangement ranged from $10 to $15 per ton. Three local dealers were willing to pick up loose newsprint from one location on the Post but stipulated that the paper be contained in some way, e.g., in Gaylords.

Table 6

Categories I and II - Central Processing Requirements and Estimated Costs*

Item	Amount	Cost/Unit	Total Cost	Life (yrs)	Cost/ Month
1) Equipment and Facilities					
A) Compactors	4	$12,000	$48,000	8	$ 500
B) Compactor O & M	4	500/yr	--	-	167
C) 8 yd3 Dumpsters	10	500	5,000	8	52
D) Baler, tractor, forklift	1	40,000	40,000	8	417
E) Modifications to Buildings 2027 or 829 including engineering	-	--	36,000	20	150
F) Building and equipment	-	250/mo	--	-	250
maintenance	-	250/mo	--	-	250
G) Utilities	-	250/mo	--	-	250
H) Dinosaur truck	32 hr/month	4.86/hr	--	-	156
I) Front-loading packer	16 hr/month	4.86/hr	--	-	78
J) Publicity	16 hr/month	4.86/hr	--	-	25
Subtotal Equipment and Facilities					$ 2,045
2) Personnel					
A) Collection Personnel	48 hr/month	10.50/hr	--	-	504
B) Processing Facility Personnel	320 hr/month	10.50/hr	--	-	3,360
C) Administration	-	--	--	-	104
Subtotal Personnel					$3,968
Total Equipment, Facilities, and Personnel					$6,013

* Does not include publicity and administration to implement the program.

General Approach

Method of Sale. All subsequent alternatives for newsprint recovery assume that the Boy Scout collection program will be discontinued. The relatively small quantities of newsprint and its low price indicate that baling the paper would not be cost-effective. Thus, only an alternative in which loose newsprint would be sold was considered in detail. A possible exception would be using the central processing facility to bale both corrugated and newsprint wastes.

Two general approaches to newsprint recovery are the drop-off container and separate collection. Drop-off containers are specially marked dumpster containers for newsprint only. The containers are usually located at commissaries, exchanges, clubs, and other locations frequented by personnel.

Separate collection involves pickup of newsprint in family housing areas. Newspapers are bundled and put at the curb or other collection point. The papers may be collected by a vehicle collecting only newspapers (separate vehicle) or by truck which also collects refuse (rack approach). The separate vehicle is often a spare refuse packer.

The rack approach involves mounting a box or rack on the underside of the body of a refuse packer. As mixed refuse is collected, the separated, bundled newspapers are put into the rack. The bulk collection activities at Fort Meade appear to be quite appropriate for the addition of newsprint collection using the rack approach. With either approach, the paper must be off-loaded into an intermediate storage container or spotted trailer.

Administration and Publicity. Administration of newsprint recovery programs primarily involves contract monitoring and complaints and operations troubleshooting. Virtually no cost estimates of current programs have been made for these activities. The extent of the effort required depends on the basic approach -- either drop-off or separate collection. Much more administration is required for separate collection programs. The following are estimates of time required for administering the programs:

	Drop-off	Separate Collection
Implementation:	32 person-hours/month	64 person-hours/month
Continuation:	2 person-hours/month	5 person-hours/month

The Boy Scouts use weekly announcements in the Post Bulletin, bimonthly spots in Sound Off, and signs posted at the PXs and commissaries to publicize collection. In addition, they distribute reminder flyers 3

to 4 days before collection. All these approaches, except for the flyers, appear to be feasible and desirable publicity methods. If the drop-off container system is used, the containers could be painted a distinctive color to help prevent people from inadvertently putting household refuse in them. At Camp Lejeune Marine Corps Base, containers painted red, white, and blue have minimized contamination. Likewise, separate collection trucks could have reminders or even cartoons painted on them to publicize the program. Costs for publicity to initiate the programs will be about $0.20 per family housing unit. This amounts to approximately $640 for the 3200 units at Fort Meade. On-going publicity will cost no more than $25 per month for poster replacement and periodic news articles.

Drop-Off Containers. The drop-off container approach would involve spotting 10 specially marked 8-cu-yd (6 m^3) containers at five places on the Post: the Main Commissary, the Main Exchange, the Commissary Annex, the golf course, and the service station. These containers would be serviced weekly by the DFAE, using a Dinosaur truck. Approximately 4 hours of truck and driver time would be required. After each collection, the Dinosaur truck would be driven to the loading dock where the papers would be ejected onto the dock adjacent to a trailer. The paper would then be hand-loaded into trays and wheeled into the trailer. Approximately 4 person-hours each week would be needed for this tranfer operation. Table 7 lists the costs associated with this alternative.

This approach has been found to recover approximately 15 percent of the available newsprint. Thus, approximately 8 tons of newsprint could be recovered each month using this approach.

Separate Vehicle. All forms of separate collection yield approximately twice the recovery rate of drop-off containers. Thus, approximately 16 tons of newsprint could be recovered using this approach.

Source-separated newspapers would be set with the general refuse at each dwelling unit on one regular refuse collection day each month, e.g., first Tuesday, second Wednesday. A separate packer truck with two-man crew would cover all the routes to be collected (refuse) that day. One such crew can collect 5 to 6 tons (4.5 to 5.4 mt) per day. Collections at Fort Meade are made semi-weekly with collections made 6 days per week. Thus, one crew should be able to collect all paper in three consecutive days each month.

Paper Collection Day	Normal Refuse Collection
1st Tuesday	Tuesdays and Fridays
1st Wednesday	Wednesdays and Saturdays
1st Thursday	Mondays and Thursdays

**

Table 7

Drop-Off Container Newsprint Recovery Requirements and Estimated Costs*

Item	Amount	Cost/Unit	Total Cost	Life (yrs)	Cost/ Month
1) Equipment					
A) 8 yd^3 Containers	10	$500	$5,000	8	$ 52
B) Dinosaur Trucks	16 hr/month	4.86/hr	--	-	78
C) Publicity	--	--	--	-	25
Subtotal Equipment					$ 155
2) Personnel					
A) DFAE Collection	32 hr/month	10.50/hr	--	-	336
B) Administration	2 hr/month	12.97/hr	--	-	26
Subtotal Labor					$ 362
Total Equipment and Personnel					$ 517

* Does not include publicity and administration costs for program implementation.

Thus, this approach will require 24 hours of truck time and 48 person-hours of labor. The paper will be hauled to the loading dock and transferred as in the approach for the drop-off container.

This collection could either be contracted or handled by DFAE personnel, using one of the rear packers employed for bulky collection. The latter approach was assumed for the costs shown in Table 8.

Rack Approach. The rack approach could be implemented in conjunction with DFAE bulky waste collection activities, with racks attached to the rear loaders. The crews could stop for bundled paper set at the curb along their routes, putting the papers in the rack. When the route was completed, the crew would unload the paper into one of the trays inside the trailer at the loading dock.

This approach would allow more frequent collection of newsprint, which leads to higher participation rates. The following assumptions were made about this alternative:

1. Weekly collection

2. Potential stops at 3128 housing units (actually less than this number because of apartment units) with 50 percent participation (approximately 1500 stops per day)

3. Incremental time per stop - 15 seconds

4. Quantity of paper recovered - 26 tons (23.6 mt) per month

5. Time for unloading racks - 20 person-hours per month.

Although the three vehicles collect bulky wastes along these routes twice a week, all crew and truck time is charged to the recovery program. Thus, 6.25 truck-hours per day (25 per month) are charged to the program, as are 50 person-hours per month for the stops, plus 20 person-hours per month for unloading paper (see Table 9).

Cost Analysis

Introduction

A cost analysis was made to compare the costs of the various individual material recovery alternatives and to compare those costs against the current cost of refuse collection and disposal used at Fort Meade. Costs were balanced with expected net revenues (gross price for material minus the 20 percent retained by DPDO for contract management). In some instances (corrugated program), credit was given for the diversion of a relatively large percent of the waste stream from the routine collection

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Table 8

Separate Vehicle Newsprint Recovery Requirements and Estimated Costs*

Item	Amount	Cost/Unit	Total Cost	Life (yrs)	Cost/ Month
1) Equipment					
A) Collection Vehicle	24 hr/month	$ 4.86/hr	--	-	$117
B) Publicity	--	--	--	-	25
Subtotal Equipment					$142
2) Personnel					
A) Collection Labor	48 hr/month	$10.50/hr	--	-	504
B) Administration	4 hr/month	12.97/hr	--	-	52
Subtotal Personnel					$556
Total Equipment and Personnel					$698

* Does not include publicity and administration costs for program implementation.

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Table 9

Newsprint Recovery Requirements and Estimated Costs*

Item	Amount	Cost/Unit	Total Cost	Life (yrs)	Cost/ Month
1) Equipment					
A) Racks	3	$300	$900	5	$ 15
B) Collection Vehicle	25 hr/month	4.86/hr	--	-	122
C) Publicity	--	--	--	-	25
Subtotal Equipment					$ 362
2) Personnel					
A) DFAE Collection	70 hr/month	$10.50/hr	--	-	$ 735
B) Administration	4 hr/month	12.97/hr	--	-	52
Subtotal Personnel					$ 787
Total Equipment and Personnel					$1,149

* Does not include publicity and administration costs for program implementation.

and disposal system. Net costs (and savings) were calculated on a per ton and per month basis.

The general approach tended to be conservative for recovery alternatives costs. In most instances, the alternatives were charged for equipment and personnel that might not always be charged to such programs, e.g., charging the stationary compactors and their maintenance to one approach to corrugated recovery. Critics might say that the compactors are and would be in place anyway for mixed refuse and should not be charged against material recovery. Likewise, some crew and vehicle time that might be considered part of the present work day was charged to the two separate collection alternatives for newsprint. Thus, this approach generally shows the recovery alternatives in a realistic to poor financial light.

Exceptions are the cost estimates for publicity and administration. These are quite difficult to project because they are site specific and are highly dependent on the individual personnel. Thus, these estimated costs may be less than realistic.

Assumptions

Diverted Disposal Savings. Theoretically, if material is removed from the waste stream, part or all of its collection and disposal costs can be credited to the operation which diverted it. As an example, corrugated material which is diverted from disposal by baling and sale, "saves" its cost per ton for waste collection and disposal. No refuse truck collects it, and it occupies no landfill space.

In reality, however, it is virtually impossible to realize 100 percent of the theoretical diverted disposal savings. Factors to consider when assigning these savings to a material recovery program include:

1. An adequate amount must be diverted. No real savings can be realized if each refuse container has 2 percent less waste in it and still must be emptied. However, if one of two containers no longer has to be emptied (it is "emptied" to sell the paper), then truck and crew time are saved. Likewise, if the overall amount of waste collected for disposal is reduced, less landfill space will be required (extending the landfill site's life) and less operator and equipment time will be required.

2. Adjustments must be made to realize the savings. Major credit for diverted disposal savings can only be shown legitimately if the refuse collection and disposal system is modified as a result of the material recovery activity. More than 50 percent savings could not be credited unless the costs of men and vehicles collecting and disposing of wastes actually decreased through reduced numbers, fewer hours worked, or fuel or material savings.

The waste stream must generally be reduced by 10 to 25 percent before there are any actual cost savings for an existing collection and disposal system. This is due to the high fixed cost for equipment to collect and dispose of waste on installations such as Fort Meade. Recovery of all high-grade paper generated at the Post will reduce the waste flow by 1.5 percent, enough to justify applying disposal credits. Newsprint recovery, representing a possible 2 percent reduction, also has little potential for affecting disposal costs.

It would be justifiable, however, to credit corrugated recovery, representing more than 12 percent of the waste stream, with diverted disposal savings. A reduction of this magnitude will extend the life of the Post's landfill; likewise, the collection fleet will travel fewer miles, because compactors at the commissaries will not be pulled to go to the landfill, and less costly waste removal services can be provided to these locations. While these savings should be realized, they do not approach the full impact possible from diverting even this amount of corrugated wastes. To credit the corrugated programs with 100 percent of their diverted disposal savings (tons diverted times cost per ton for waste collection and disposal) all overall operations in solid waste management would have to be reduced 12 percent--a nearly impossible achievement. Therefore, due to the potential difficulties in saving the entire cost per ton for collection and disposal ($54.24 per ton [$59.67/mt] of mixed refuse), only a 25 percent credit ($13.56 per ton [$14.92/mt]) was given to each corrugated recovery alternative.

Allocation of Personnel and Equipment to Source Separation. In most of the alternatives, relatively small amounts of time each month were estimated for personnel and equipment. It was assumed that these trucks, other equipment, and personnel were currently being used at Fort Meade and that the source separation program could "buy" increments of their services.

There is sufficient excess equipment without having to purchase additional equipment; however, if a central processing and storage facility is developed, a baling system, forklift, and tractor will have to be purchased.

Lack of sufficient DFAE personnel is a major constraint to any Post-operated program. If recovery of any grades of paper is practical, manpower will have to be formally allocated to the recovery program. It was not possible to determine if program requirements would be met with existing personnel. This is a decision that the Post must make after evaluating the economy of the proposed system.

Market Prices and Revenue Flows. Market prices used in the analysis are averages based on quotes made during the survey. The prices are based on current market indices which are subject to fluctuations. Prices used in the analysis are felt to be representative of an average price for the next 5 years, barring any severe economic depression. Any

sales contract developed by the Defense Logistics Agency should include floor prices representing an economic breakeven point for the Post. The following market prices are used for the analysis:

1. High-grades - $60 per ton ($66/mt)

2. Newsprint, baled - $30 per ton ($33/mt)

3. Newsprint, loose - $15 per ton ($16.50/mt)

4. Corrugated, baled - $30 per ton ($33/mt)

5. Corrugated, loose - $15 per ton ($16.50/mt)

DPDO retain 20 percent of the gross sales price of recovered materials to establish and manage the sales contracts. This is reflected in the cost analysis shown in Table 10. The revenues shown were adjusted to correct for this 20 percent retention.

DFAE is currently operating a mixed paper recovery program. Mixed office paper is collected twice weekly from approximately 15 buildings and transported to the DPDO where it is baled and sold under a term contract. Slightly less than 4 tons (3.6 mt) of paper are recovered each week.

An alternative to recovering high-grade paper from offices is the incorporation of a high-grade program into the mixed paper program with the paper all sold as a mixed grade. Operations would be essentially those now used in the mixed paper program. Costs are outlined in Table 10. Note the recovery rate of 15 tons (13.6 mt) per week is the current mixed paper rate plus an average of the three high-grades programs.

Interpretation

Recovering high-grade paper costs more per ton than the current cost of collecting and disposing of the material as waste. Only the Category I buildings approach is close to the mixed refuse cost ($59 per ton [$64.91/mt] vs. $54 per ton [$59.41/mt]). This, plus the fact that mixed refuse costs could be reduced indicate that no attempt should be made to recover high-grade paper at Fort Meade.

The other alternatives shown in Table 10 have costs per ton lower than that of mixed waste. The first two approaches to corrugated recovery even show new profits (savings).

Table 10

Cost Analysis Summary

Contributing Cost Factor	Solid Waste Management Prior to Source Separation	High-Grade			Newsprint				Corrugated		
		Category I	Categories I&II	Categories I,II,&III	Mixed Paper	Drop-off	Separate Vehicle	Rack Approach	Category I-Baling	Commissaries Stationary Compactor	Categories I&II Central Processing
Estimated Waste Generation (tons/month)											
Total Mixed Waste	1,044	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A
Recovered	N/A	11	11.7	12.5	15	8	16	26	124	72	128
Estimated Costs ($/month)*											
Equipment	**	199	477	585	181	155	142	362	513	666	2,045
Personnel	**	968	1,861	2,571	915	362	556	787	1,656	375	3,968
Total Cost	56,633	1,167	2,338	3,156	1,096	517	698	1,149	2,169	1,041	6,013
Assumed Material Price ($/ton)	N/A	60	60	60	40	15	15	15	30	15	30
Revenues***($/month)	N/A	528	562	600	600	96	192	312	2,976	864	3,072
Diverted Disposal Savings ($/month) at $13.50/ton (assumed)	N/A	149	158	169	202	108	216	351	1,681	936	1,736
Total Value	N/A	677	720	769	802	204	408	663	4,657	1,800	4,808
Net Cost (Savings) Per Month ($)	56,633	490	1,618	2,387	294	313	290	456	(2,488)	(759)	1,205
Net Cost (Savings) Per Ton (4)	54	45	138	190	20	39	18	19	(20)	(11)	9

* Does not include publicity and administration for implementation of any source separation program.
** See Table II-15 in Subtask 2.2 report for details.
*** Gross material price times tons recovered per month minus 20 percent for DPDO contract administration

The primary reasons for the overall loss situation (except for the two corrugated alternatives) are labor costs and distance to market. Material recovery is a labor-intensive operation, particularly at installations like Fort Meade where sources are spread over a relatively large geographical area and where many sources are small buildings generating small quantities of recoverable materials. Markets for the materials are 20 miles (32 km) or more from Fort Meade, which reduces the price.

Newsprint recovery appears marginally feasible, with different forms of separate collection being the most cost-effective approaches. Either the separate vehicle or rack approach could be incorporated into the current bulky waste collection effort; this would reduce overall costs through improved efficiency and revenues from the sale of paper. The major drawback is the current Boy Scout newspaper program. Both efforts could not survive. If the Post implemented newsprint recovery, the Boy Scout program would have to be abolished--a decision that may be unpopular at Fort Meade.

Recovery of corrugated wastes appears to be the most cost-effective of all material recovery programs. Baling corrugated at two commissary and one exchange locations would provide a $20 per ton ($22/mt) (nearly $2500 per month) profit. The profit will be smaller if corrugated is collected only at the commissaries and if stationary compactors are used. The central baling of nearly all Fort Meade's corrugated shows an overall loss but will cost much less than mixed refuse management. The commissaries may have a severe personnel shortage. Therefore, obtaining authorization for personnel to operate the central processing facility may be difficult.

3 RECYCLING AT FORT LEWIS, WASHINGTON

Recycling began at Fort Lewis, WA, in late 1973. Lack of documentation and turnover of personnel responsible for the program have resulted in a lack of specific information about most of the program's history.

The program, which has always been voluntary, has been the responsibility of the DFAE and has been specifically assigned to the Energy Conservation and Environmental Office.

The program began with corrugated material from the commissary which was hauled to a central processing facility, baled, and sold through DPDO. In the past 3 years, added interest by the Director, the DFAE, and the Assistant Division Commander for Support has expanded the program to include many more materials, and it now yields increased recovery rates.

Recyclable materials are now collected in drop-off containers at the commissary and other convenient points and in containers in approximately 35 buildings housing administrative functions. The materials are hauled to the Recycling Center where military personnel on temporary assignment sort, crush, bale, and store the materials prior to sale.

A wide variety of materials is recovered; however, only corrugated is sold on a term contract. The following are the types and estimated recovery rates of the collected materials:

1. Corrugated - 59.4 tons (54.0 mt) per month
2. Newsprint - 3.8 tons (3.5 mt) per month
3. Computer print-out - 5.2 tons (4.7 mt) per month
4. Mixed ledger - 2.5 tons (2.25 mt) per month
5. Scrap (mixed) paper - 5.6 tons (5 mt) per month
6. Glass (all colors) - 6.4 tons (5.8 mt) per month
7. Small amounts of steel and aluminum cans, telephone books, manuals, maps, and beer bottles.

According to the Annual Report of Solid Waste Source Separation and Resource Recovery/Recycling Operations filed by Fort Lewis for FY 1977, the program's income exceeded its expenditures by more than $26,000. These funds were used to establish an ecology park and to construct a waste-oil-burning facility.

Plans have recently been approved to make the recycling of most grades of paper and waste oil mandatory. Fort Lewis Regulation 420-25, dated 31 May 1978, describes responsibilities and procedures for recovering and processing these materials.

Fort Lewis Background

Fort Lewis encompasses 84,000 acres (34 000 hectares) of land along the southeast border of Puget Sound, and is situated between the Cascade Mountain Range to the east and the Olympic Peninsula to the west. The installation is approximately 13 miles (27 km) south of Tacoma, WA. McChord Air Force Base borders the installation on the northeast.

As of 1977, the personnel assigned to Fort Lewis included 23,000 military and 3800 civilian personnel plus 11,300 retired military personnel served by the installation. Currently, there are 2506 on-post housing units, and 8350 civilian and military on-post office workers.

The mission of Fort Lewis is to house the 9th Infantry Division. The three brigades comprising the 9th Infantry and its support elements undergo field training exercises, maintenance, and support as part of the training and operations program at Fort Lewis. Nondivisional organizations at Fort Lewis include the 593rd Support Group; the 1st Signal Group; the 62nd Medical Group; the School Command; the 2nd Battalion (Ranger) 75th Infantry; the Law Enforcement Command; the 4th ROTC Region; the Fort Lewis Readiness Group; the Troop Support Agency (Commissary); the 10th Aviation Battalion; the Fort Lewis Readiness Group; and a 6th Army Unit.

Recycling at Fort Lewis

Until 1977, the program begun under Post Regulation 420-25 was under the joint auspices of DFAE refuse control and DPCA welfare activity. Policy guidance was provided by the Environmental Quality Committee. Funds derived from the program were deposited into a central Post Welfare Fund, and disbursement of these monies was under the direction of the Fort Lewis Central Post Fund Council.

Before 420-25 was revised in 1977, the commissary (Troop Support Agency) received revenues from the program. A later decision was made between the commissary and DFAE not to return revenues from corrugated materials to the commissary, since the program was handled by DFAE. The commissary now pays DFAE to haul refuse to the sanitary landfill and corrugated material to the Recycling Center.

A revision of Post Regulation 420-25 is currently being drafted that would make portions of the recycling program mandatory. Materials involved would be high-grade paper, corrugated paper, computer printout, computer tab cards, and newsprint.

The proposed regulations also call for steel and aluminum cans, glass, and scrap (mixed) paper to be collected and processed; however, their source separation will not be mandatory.

Manning procedures for the Recycling Center have caused some inefficiency. Assigning personnel to the Center for periods as short as one day requires constant retraining in operations and safety procedures and particularly in the methods used to sort the materials. Proposed changes will provide for personnel to be assigned to the Center for 1 year as a special-duty assignment.

Overall records of the history, operations, material quantities, and revenues were sketchy because of the voluntary nature of the program, the high turnover rate at the Recycling Center, and the temporary nature of the assignment of an individual officer (Energy Conservation Officer) to the responsibilities of the recycling program. The current Energy Conservation Officer is developing a more complete system for program documentation. The development of the mandatory program should make the effort more formal.

Material Recovery

Material recovery at Fort Lewis is basically the voluntary source separation of several types of recyclable materials. Participants deposit these materials in specially marked containers located around the installation and inside selected buildings. Figure 7 illustrates the flow of recyclable material at Fort Lewis.

Sources

Sources of recyclable material include drop-off containers located outside the commissary, hospital, and other areas; fiber drums and similar containers located in buildings housing administrative-type activities; and a stationary compactor located at the commissary and used for corrugated material only. The drop-off containers are used for a variety of paper grades, cans, and glass. The smaller containers are used for high-grade and mixed paper.

Drop-off Containers. More than forty 8-cu-yd (6-m^3) lugger-type containers for recyclable materials are located throughout the Post. The largest concentration of containers (14) is at the commissary and at locations, such as the hospital, that are frequented by military and civilian personnel and dependents. Figure 8 gives the locations of the containers and the Recycling Center.

The drop-off containers and the surrounding area are well marked with signs which identify the purpose of the containers and provide instructions about acceptable materials and how they should be prepared. At the commissary, an additional container marked for trash has been

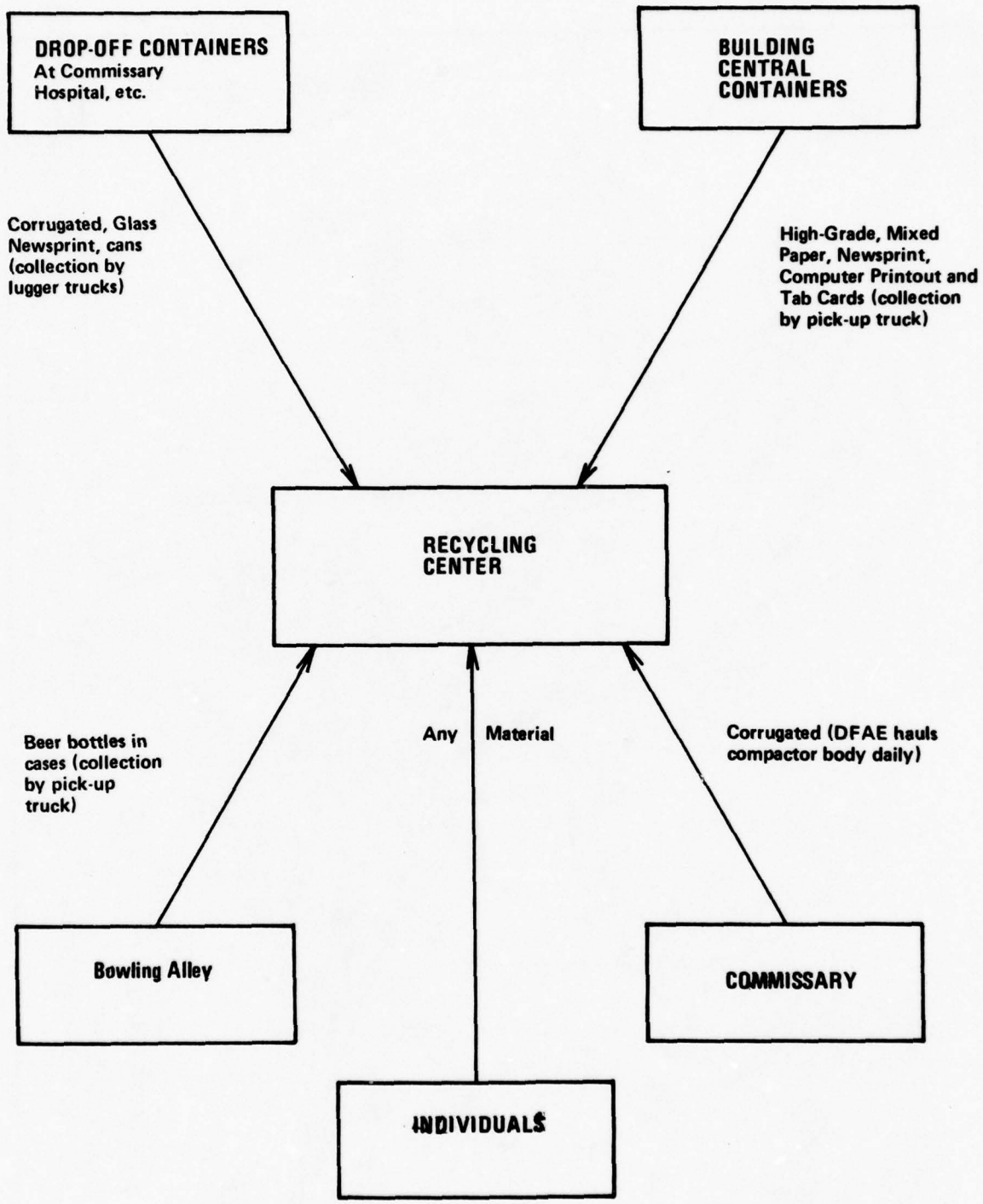

Figure 7. Recyclable material flow at Fort Lewis.

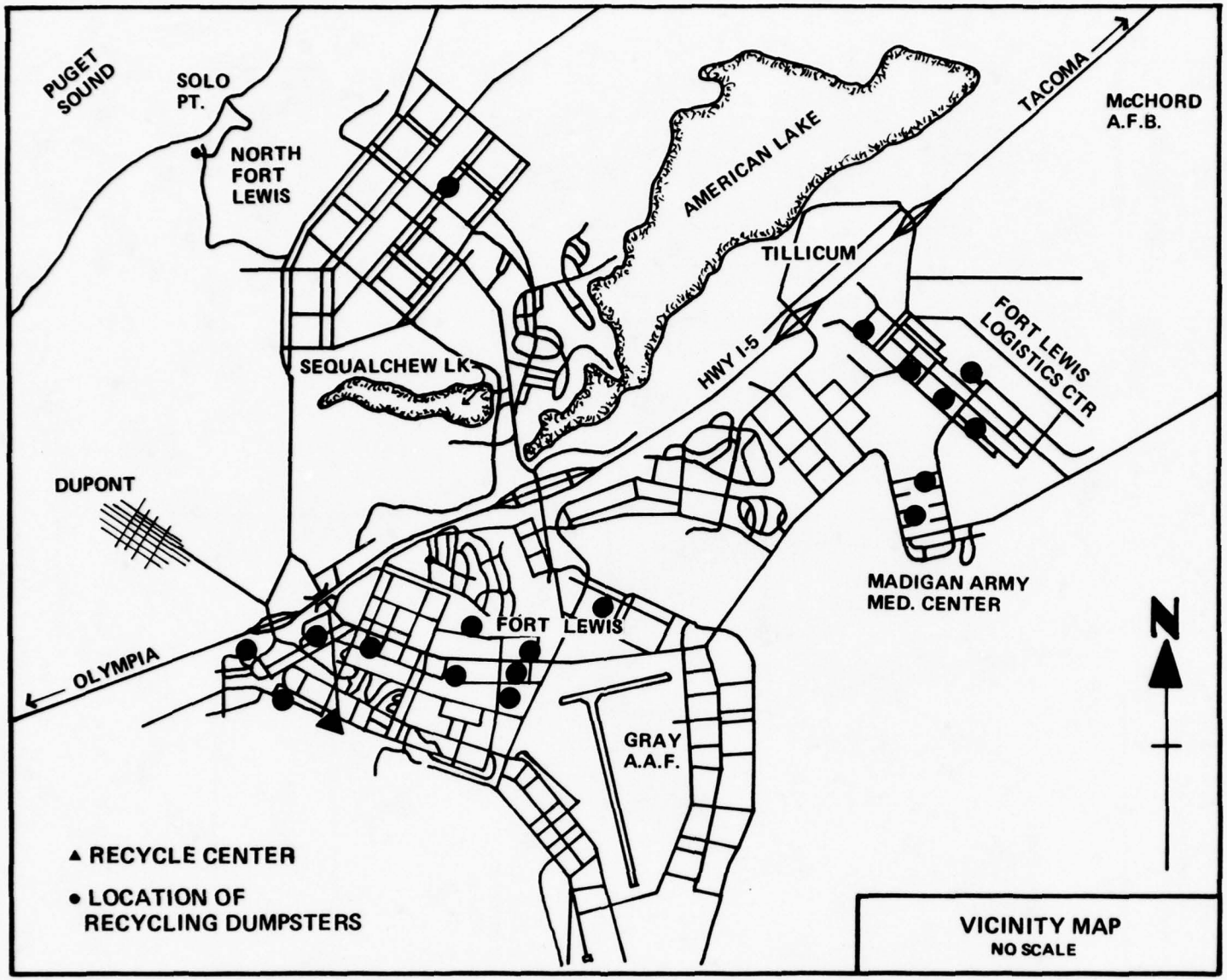

Figure 8. Recycling locations at Fort Lewis, WA.

provided to reduce the amount of contaminants in the recycling containers.

Special care is taken to keep the containers in as straight a line as possible and to keep the surrounding area policed, thus encouraging both participation by the personnel and cooperation in maintaining a good appearance. Individual containers are painted white with a logo stenciled on each; the name of material to be deposited is stenciled in approximately 4-in. (100-mm) letters.

At the commissary, containers are provided for newsprint, corrugated material, aluminum cans and scrap, steel cans, and glass (separate containers for clear, green, and brown).

Containers spotted elsewhere are designated for material generation specific to the surrounding areas. A container for clear glass is positioned outside the hospital laboratory, while containers for corrugated are spotted in the logistics warehouse area. The DFAE originally donated the containers to the recycling effort.

The original generation rate of recyclable materials was estimated in accordance with FORSCOM guidelines. However, these figures were not available due to the turnover of the personnel since 1974. The projections for the current program (see Figure 9) were made in mid-1977.

Commissary. The Fort Lewis commissary has been part of the recycling program since 1973. Its current average monthly gross sales are $2.3 million. Refuse from the commissary is moved to one end of a covered loading dock where there are two containers. One is a 43-cu-yd (33 m) roll-off compactor marked for corrugated material only. The only adjacent 40-cu-yd (31 m^3) roll-off bin is for all other refuse. Stock clerks have been informally instructed to put noncontaminated corrugated materials in the compactor and to operate the compaction mechanism whenever necessary. Commissary supervisors and clerks indicate that essentially no additional time or effort is required to separate the corrugated materials and operate the compactor.

The compactor and roll-off bin are provided and hauled by the DFAE Sanitary Engineer crews. The corrugated compactor is hauled approximately once a day to the Recycling Center where it is unloaded. The refuse bin is hauled to the on-site landfill for disposal. The DFAE requires that the commissary separate the corrugated material and also charges the commissary for hauling the materials (both corrugated and refuse). The commissary receives no revenue from the corrugated.

Buildings. An informal approach to source separation has been established in 35 buildings at Fort Lewis. The overall recycling program is publicized periodically in the Daily Bulletin and the installation newspaper, The Ranger. These articles indicate that any branch or section chief or other supervisor who wants to participate can phone the

FORT LEWIS

PROJECT OFFICER 2LT DAULA
PHONE NUMBER 957-5337/5646

CATEGORY	
1. Administration Workers	
Engrs, Accountants, Staffing Personnel, etc.	3,708
Secretaries	61
2. Unit Headquarters Personnel	
Officer	839
Warrant	116
Enlisted	3,525
3. Warehouse Personnel	569
. Maintenance Facility Personnel	
Consolidated Maintenance	705
Consolidated Motor Pools	1,594
5. Food Service Facilities - # meals served/day	
Clubs	830
Mess Halls	15,362
AFFES Snack Bars	5,729
6. Commissary Facilities - $ Sales/week	$450,000
7. Retail Facilities - # Employees	
Banks	40
Class 6 Stores	11
PX Sales	521
Others	54
8. Hospital Facilities - Main Only - Beds	561
9. Education Facilities - Staff Members	
Primary & Secondary	144
Military Education Centers	146
10. Family Housing Quarters	3,506
11. Computer Cards To Be Determined At Each Installation.	

TABLE VI-1A
TONS PER MONTH

CATEGORY	HIGH GRADE PAPER	CORRUGATED	NEWSPAPER
1	155	---	---
2	22.6	---	---
3	13.0	21.4	---
4	---	---	---
5	---	24.1	---
6	---	88.1	---
7	---	9.6	---
8	9.9	6.6	---
9	2	---	---
10	---	---	45.7
11	To be determined on Local Conditions	---	---
Total (To be furnished Local PDO)	61.2	149.8	45.7

Figure 9. Estimated generation rates for recyclable paper, 1977.

Recycling Center for assistance. Recycling Center personnel determine the types of materials likely to be generated within the building and provide an appropriate number of labeled containers to the individual requesting them. That person is then instructed about the correct separation techniques for the material and is encouraged to educate his/her office personnel. The containers are then located within hallways, wings, or day rooms, depending on the building's function.

It was noted that the containers are not marked uniformly and that there is a high degree of contamination, both in the mixing of recyclable material types and the inclusion of nonrecyclables such as apple cores. Several metal trash cans (some painted white, others not) were observed in wings and office areas within the building. Although some cans were labeled "high-grade paper," others were labeled only "paper." Every paper container seemed to contain a mixture of papers, computer printout, tab cards, and general refuse. Newsprint was bundled and stacked near the containers. In some areas, computer printout and tab cards were separated and stored in their original boxes. Containers for cans were located near vending machines.

Within offices themselves, the decision to segregate material via desk-side methods appears to be left up to the individuals. In some offices, employees have placed containers for corrugated waste under their desks to separate high-grade paper from mixed paper, or computer printout from high-grade or mixed. The separation of materials is at the discretion of the office workers. Within an office area, some choose not to use desk-side containers, but instead, take their material to the hallway containers as it accumulates. Because of the voluntary nature of the office involvement and the inability to determine just how many people within an office were actually contributing to the program, no estimate of the number of participants could be made.

Other. Several activities at Fort Lewis are participating in the recycling program by donating various other materials. Some offices call the Recycling Center when they have an accumulation of outdated Technical Manuals, maps, or other publications. Center personnel collect and store these materials hoping to sell them through the DPDO in their original form, i.e., as manuals, rather than as high-grade or scrap paper. To date no such sale has been made.

Fort Lewis has begun collecting and selling nonreturnable beer bottles, because local brewers will buy them back (in case lots only). Arrangements have been made with the bowling alley and clubs at Fort Lewis to separate and store these bottles in their original cases. However, the limited number of acceptable brands (three) and the use of canned beer make this a minor portion of the recycling effort.

Collection Procedures

With the exception of the commissary compactor, all collection and hauling of recyclables is accomplished by Recycling Center personnel. DFAE has donated three lugger trucks to the program which are used to pick up the containers, haul them to the Recycling Center, empty them, and return them to their locations. A driver from the Center checks each container daily to determine which ones require emptying. In some cases, personnel stationed near the containers call the Center to request that the container be pulled. A roster is maintained at the Center to tabulate how often each container is emptied, its location, and the type of material it contains.

While only one truck is needed for collection, two back-up trucks are needed because the vehicles are old and get low-priority maintenance. Sometimes the lack of a qualified lugger truck driver has caused collection delays.

A 1-ton (0.91-mt), covered pickup truck has been assigned to the Recycling Center and is used to collect materials from the participating buildings. A designated person in each building calls the Center when containers are full. One or two personnel from the Center empty the containers into fiber drums (keeping the types of recyclable materials as separate as possible) and haul them back to the Recycling Center.

Material Processing

Recyclable materials recovered at Fort Lewis are processed (sorted, baled, crushed, etc.) in a central facility--the Recycling Center. They are then stored temporarily in the Recycling Center or moved to a warehouse (approximately 1/4 mile [0.4 km] away) for storage until sale. Figure 10 shows the floor plan for the Recycling Center.

Personnel

The Recycling Center is currently manned by nine military personnel, E-6 through E-2, who are on special duty. These personnel are awaiting assignments, on short tours of duty prior to retirement, or for other reasons not assigned to a specific position at Fort Lewis. The mission of Fort Lewis appears to give rise to the availability of personnel in this status and, thus, likely candidates for assignment to a recycling program.

Until recently, assignments to the Recycling Center have ranged from 1 day to 1 year. The rapid turnover and the fluctuating numbers of personnel have caused delays in processing recovered materials. To alleviate this problem, the Facilities Engineer has assigned nine persons to special duty at the Center (see Figure 11). These longer-term assignments should increase productivity at the Center as increased quantities of material are received.

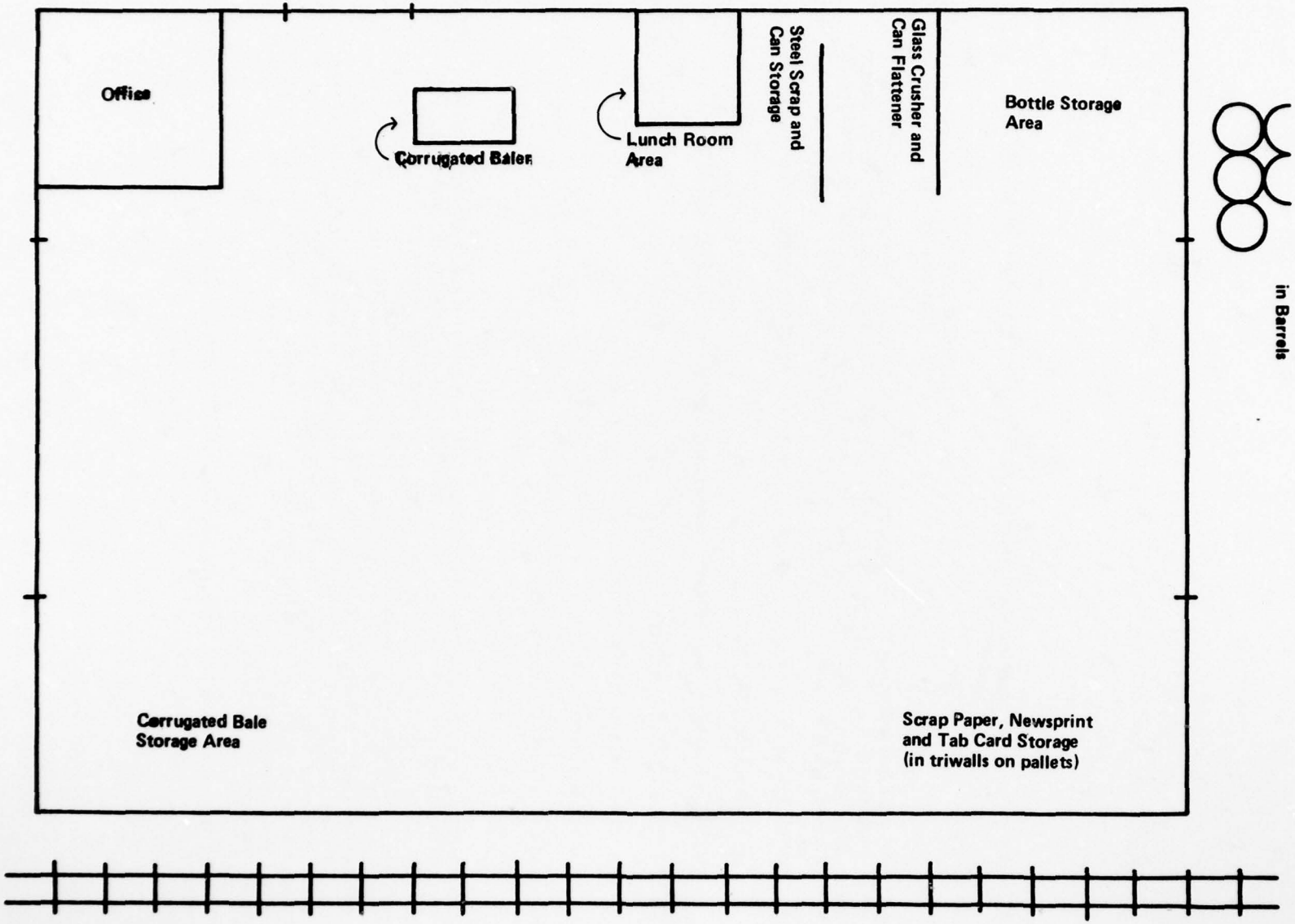

Figure 10. Layout of Recycling Center at Fort Lewis.

AFZH-FEQ Special Duty Requirements for the Fort Lewis Recycling Center

14 Feb 1978

G-1 DFAE CPT Chaky/dw/4076

1. On 6 February 1978 the DIC related to DFAE that the 864th Engr Bn would relinquish the mission tasking for providing personnel to the Fort Lewis Recycling Center on or about 26 April 1978. Based upon this action DFAE was solicited to provided G-1 with the special duty requirements to replace the 864th personnel.

2. The following are the personnel requirements for the Fort Lewis Recycling Center:

1 E-7 Recycling NCO

3 E-5/E-6 Commodity Supervisors (Warehouse, Operations, Processing)

2 E-2/E-4 Forklift Drivers

1 E-2/E-4 Tank Truck Operator

1 E-2/E-4 1 Ton Truck Driver

2 E-2/E-4 Dumpster Operators

4 E-2/E-4 Commodity Workers

The assignment of the above mentioned personnel on special duty assignment would ensure increased production required by the increase in support of recycling efforts on Fort Lewis. The work load on the Recycling Center has increased dramatically in the past few months as more personnel on the installation become aware of the recycling program. Fort Lewis has been commended for its recycling efforts by FORSCOM and the Environmental Protection Agency. Should the Center not continue its expansion efforts, potential funds from the recycling program will be lost to Fort Lewis and a great quantity of material will be relegated to the landfill. This request exceeds the present mission tasking assignment by reducing the commodity supervisors by three but increasing the number of drivers by two and adding four commodity workers. A net increase of three personnel is the result.

3. POC for assignment of recycling personnel is CPT Chaky 4076/4032.

GUNARS KILPE
Colonel, CE
Facilities Engineer

Figure 11. Current assignments at Recycling Center.

Four supervisory personnel (E-7 through E-5) manage the activities at the Recycling Center. These personnel record the number of times each lugger container is pulled, the number of bales processed, etc., and supervise up to seven enlisted men (E-4 through E-2). They operate the pickup and lugger trucks; operate the balers, glass crusher, and forklifts; and sort materials.

Equipment

Equipment currently used at the Recycling Center includes:

1. One 1-ton (0.91 mt) pickup truck, obtained from the Transportation Motor Pool at no charge

2. Two forklifts (6000-lb [2727.3-kg] commercial) obtained on loan from D10

3. One compactor-baler (donated by the Officers' Wives Club) which generates approximately 1000-lb (.45 mt) bales of corrugated

4. One can flattener, which is actually an old uniform baler excessed as World War II equipment

5. One "home-made" glass crusher

6. Three lugger trucks assigned to the Recycling Center at no charge from DFAE, Sanitary Engineers

7. Barrels, pallets, and cartons obtained through DPDO as excess.

Operating Procedures

Normal operating hours at the Recycling Center are from 0730 to 1630, Monday through Friday. Materials are received, processed, and stored during duty hours. Corrugated is sold on a term contract. When sufficient quantities are accumulated, the contractor is notified and his truck is loaded by Center personnel.

The most striking feature of the operations in the Center is the degree of hand sorting and contaminant removal necessary to produce a recyclable material that is sufficiently pure to be saleable and to obtain the best possible prices for this material. Fort Lewis attempts to get the most revenue out of its recyclables. Hand-sorting is particularly necessary for the materials coming from the participating buildings. This requires separating computer printout from tab cards, scrap paper, and newsprint. Often all are mixed in the containers located in the buildings. This contamination can be corrected only by large amounts of manual labor or by more intensive public relations/education effort.

Corrugated Material. Corrugated from the commissary and drop-off containers is unloaded onto the floor of the Center near the baler. Personnel remove contaminants and feed the corrugated into the baler with the aid of a forklift. As the 1000-lb (450 kg) bales are ejected, they are moved by forklift to a storage area inside the building near a door. When a sufficient quantity of bales (about 35) is accumulated, the contractor is notified by phone. When the truck arrives, it is loaded by Center personnel and weighed at the DPDO scales.

High-Grade Paper. High-grade paper is brought to the Recycling Center from the 35 buildings voluntarily participating in the program. Very high levels of contamination require manual sorting. High-grade paper is stored loose in heavy corrugated boxes (the refrigerator and other appliance boxes) called triwalls which are strapped to pallets for moving with forklifts. Currently, the high-grade paper is denoted as "paper, scrap, including high-grade computer printout," and is offered for sale. It is stored in increments of 66 pallets and offered for sale as 40 net tons (36.4 mt).

Aluminum and Steel Cans. Cans are brought to the Recycling Center from drop-off containers, central collection containers, and individuals, and dumped on the floor of the Center away from the corrugated baler. In addition, many cans used on maneuvers are recovered and returned to the Recycling Center. Personnel at the Recycling Center manually separate the aluminum cans from the steel cans. The cans are then flattened by a World War II uniform baler, shoveled into fiber barrels, and stored in the Center. Pilfering of aluminum cans from central collection points has been an on-going problem, since it is well known that local markets will pay $.17 per pound ($0.37/kg) for the material.

Aluminum Scrap. Inert aluminum projectiles are recovered from the firing range after troop exercises and stored in the warehouse. In addition, 350 aluminum-covered buildings scheduled to be demolished for hospital expansion will be contributed. A potential market for this material has been identified through the DPDO regional office. To date, these buildings have not been demolished. Storage limitations at the warehouse would preclude storing this material, so other provisions will have to be made if the material is to be stored for sale as scrap.

Newsprint. Newsprint drop-off containers are hauled to the Recycling Center and emptied. The paper is hand-stacked on pallets, using an alternating stacking method, and strapped down. The majority of all newsprint processed at the Recycling Center comes from the commissary collection point and one of four dumpsters located at the hospital. Currently 65 pallets of the material are stored in the warehouse and have been listed in a one-time sealed bid IFB. Each pallet contains approximately 1000 lb (.45 mt).

Computer Tab Cards. Some of the incoming material from individual buildings contains computer tab cards that have been separated and stored in individual boxes. However, in some buildings, computer tab cards have been deposited in cans for high-grade paper. Recycling Center personnel manually separate the cards from the other material and store them in refrigerator boxes on pallets. Most of the cards are manila; the colored cards in the waste stream are stored separately.

Currently, 18 pallets of manila tab cards (16 tons [14.5 mt]) and four pallets of colored tab cards (4 tons [3.6 mt]) are being offered in a one-time sealed bid IFB.

Scrap Paper. The Recycling Center separates scrap paper and stores it in refrigerator boxes (triwalls) on pallets. Incoming paper from buildings is sorted manually and the material stored in one of the following categories:

1. Mixed scrap paper, including magazines, colored ledger, and noncarbon paper. Currently, 13 tons (11.8 mt) are offered for sale.

2. Mixed scrap paper, including envelopes, correspondence paper, and carbon-impregnated computer printout. Currently, 34 tons (30.9 mt) are offered for sale.

Training Manuals, Maps, and Telephone Books. The Recycling Center has collected and saved training and field manuals and maps from library purgings. These are left in their original shipment boxes and stored on pallets in the warehouse. A market for this material may develop; for example, repair manuals for Army equipment may have a potential market in buyers of obsolete Army equipment. If not marketable as used books, the material could be sold as high-grade paper (with the covers removed).

Telephone books are being saved and stored in the warehouse. No markets have yet developed for this material, however, but it may be sold as scrap (newspaper grade). The books are palletized separately from the other materials.

Glass. Clear, brown, and green glass (separated by color) is brought to the Recycling Center from the central collection points and the individual buildings. The material is unloaded at the rear door of the Recycling Center, crushed, and stored in barrels outside the door. When a 5-ton truckload has accumulated, DFAE borrows a truck from the motor pool transportation division and hauls the glass to a dealer's yard in Seattle. No contract has been obtained for this material. Therefore, the dealer sends proceeds from the sale of this material directly to Finance and Accounting. The price for this material can vary; the only sale to date for FY78 approximated $25 per ton ($27.50/mt) for crushed green glass.

IT HAS BEEN DETERMINED THAT THIS PROPERTY IS NO LONGER NEEDED BY THE FEDERAL GOVERNMENT

SEE INSIDE FRONT COVER FOR NAME, ADDRESS, AND TELEPHONE NUMBER OF PERSONS TO CONTACT FOR FURTHER INFORMATION AND/OR INSPECTION OF PROPERTY LISTED IN THIS IFB.

33. CONTINUED

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34. COPPER-BEARING METAL, SCRAP: Including insulated cable with reels and connectors, armatures, motors, coils and junction boxes with foreign attachments including ferrous, nonferrous and nonmetallic materials and debris.
Outside - Area S - D4CA0B Loose
40,000 POUND

Article AI: Military/Munitions List Items applies.

ITEM 35 IS LOCATED AT PUEBLO DEPOT ACTIVITY, CO.

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35. BULLET METALS, SCRAP: Consisting of target practice 20MM projectiles including aluminum, steel, and copper. Each round contains: Aluminum point - 10 grams, steel body - 114 grams, copper band - 5.4 grams.
Outside - E1MA00 A07/3A12 - Loose -
6700 POUND

The Following Articles apply:
AF: Dangerous Property
AI: Military/Munitions List Items

ITEMS 36 THRU 41 ARE LOCATED AT ELLSWORTH AFB, SD

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36. LEAD BATTERIES, SCRAP: Steel case including C&D type 8-HXC-21, 8-HXC-19 and 8-HNC-21. Undrained weight includes acid.
Outside - Area C D5RACA - On Pallets -
69,000 POUND

Article AF: Dangerous Property applies

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37. TABULATING CARDS, MANILA, SCRAP:
Inside - Bldg F A01 AFA - Packed in cardboard boxes which are included in weight and sale -
10 NET TON

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38. ALUMINUM, IRONY, SCRAP: Including window and door frames, clippings, wire and cable with ferrous and nonferrous attachments.
Outside - Area B, Bin 8 - D1DA8a - Loose
3200 POUND

Article AI: Military/Munitions List Items applies

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39. STAINLESS STEEL, MAGNETIC AND NONMAGNETIC, SCRAP: Including pipe, tubing and combustion chambers of various sizes and shapes.
Outside - Area B, Bin 4 S0QA4B - Loose -
4000 POUND

Article AI: Military/Munitions List Items applies

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40. ALUMINUM, IRONY, SCRAP: Consisting of demilitarized quail missiles, with foreign attachments including other nonferrous, ferrous and plastic covered wiring.
Outside - Area B D1EABB
3000 POUND

The Following Articles apply:
AF: Dangerous Property
AI: Military/Munitions List Items

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41. STEEL, BUSHELING, SCRAP: Consisting of used ammo links.
Outside - E1JACB - In boxes which are included in weight and sale
Est. 1830 lbs.
1 LOT

The Following Articles apply:
AF: Dangerous Property
AI: Military/Munitions List Items

ITEMS 42 THRU 68 ARE LOCATED AT FORT LEWIS, WA.

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42. TABULATING CARDS, MANILA, SCRAP: Including some tinted edges.
Inside - Bldg 9744 - A01A*A - Loose in triwalls which are banded to 18 pallets included in weight and sale
16 NET TON

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43. TABULATING CARDS, COLORED, SCRAP: Mixed colors including manila.
Inside - Bldg 9744 - A01A*A - Loose in triwalls which are banded to 4 pallets included in the weight and sale
4 NET TON

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44. PAPER, SCRAP: Including high grade computer print out paper.
Inside - Bldg 9744 - A02A*A - Loose in triwalls which are banded to 66 pallets included in the weight and sale
40 NET TON

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45. PAPER, SCRAP: Consisting of newsprint.
Inside - Bldg 1210 - A03A*A - Banded to 65 pallets included in the weight and sale
32 NET TON

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46. PAPER, MIXED, SCRAP: Including forms and bond paper.
Inside - Bldg 1210 - A02A*A - Loose in triwalls which are banded to 35 pallets included in the weight and sale
13 NET TON

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47. PAPER, MIXED, SCRAP: Included envelopes, computer printouts, correspondence paper and carbon impregnated paper.
Inside - Bldg 1210 - A02A*A - Loose in triwalls which are banded to 106 pallets included in the weight and sale
34 NET TON

Figure 12. IFB listing for recycled materials.

Beer Bottles. Since the beginning of FY78, beer bottles have been collected from the bowling alley and glass containers from throughout the post. Glass from central collection points is hand-sorted to isolate beer bottles. The bottles are stored in cases, palletized, and sold to the breweries through DPDO for $.50 per case. To date, 1729 cases have been sold.

Material Marketing

Term Contracts

Corrugated is the only material processed at the Recycling Center that is sold on a term contract. Copies of the contracts are maintained in the Regional Defense Property Disposal Office in Ogden, UT, and were not available at Fort Lewis. However, it was determined that the contractor pays 138 percent of the San Francisco market value for corrugated. With the current market at just over $25 per ton ($27.50/mt), revenues from the corrugated are currently averaging approximately $35 per ton ($38.50/mt). The corrugated sold is remade into paper bags or sold for export to Japan.

Throughout the Army, market determination is made at the regional level of DPDO. However, at Fort Lewis, the DPDO office takes an active role in determining local market values and obtains local bids for materials.

One-Time Sealed Bid Contracts

Fort Lewis currently uses one-time sealed bid contracts to dispose of most of its processed materials. More than 300 tons (272.7 mt) of unmarketed material are now stockpiled at the Recycling Center, warehouse, and the DPDO storage area, awaiting disposal through such contracts. An IFB was recently issued for manila tab cards -- 16 tons; colored tab cards -- 4 tons; newsprint -- 13 tons (11.8 mt); and mixed scrap paper -- 34 tons (30.9 mt) (see Figure 12).

Quantities of other materials are awaiting IFB listing while markets are identified. A potential market has been identified for the training manuals, but not for other miscellaneous materials.

Spot Sales

Glass is the only material sold on a spot-sale basis. DPDO was unable to identify a market that would pick up glass at Fort Lewis; however, DFAE identified a market in Seattle that would pay for glass if the Army delivered it. Consequently, a DFAE dump truck was used to haul the glass to this market. The sale of glass amounted to $1,519 for 89.3 tons (81.2 mt) or about $17 per ton ($18.70/mt). Since DPDO was not involved with this sale, all proceeds were deposited in the recycling account.

Generation Rates and Revenues

The following list gives annual totals for materials sold in calendar years 1976 and 1977.

	1976 tons	1977 tons
Corrugated	849.5	744.2
Newsprint	49.7	40.9
Computer Printout	43.1	81.5
Mixed Ledger	27.4	33.0
White Ledger	13.6	--
Scrap (Mixed Paper)	84.6	56.7
Glass	62.5	91.5
Steel Cans	12.8	--
Bi-Metal Cans	1.4	--
Beer Bottles	--	1477 cases

The decrease in tonnage sold between 1976 and 1977 reflected the installation's anticipation of new Army regulations that would return up to 80 percent of the sale proceeds to accounts used for environmental purposes. In 1977, more materials were recovered than in 1976; however, some were warehoused for sale at a later time.

Revenues were available for the corrugated and glass sold during FY77 plus other sources of income. The FY77 Annual Report shows that nearly 786 tons (796.4 mt) of corrugated were sold for approximately $28,920, and the 89.3 tons (81.2 mt) of glass were sold for $1519. Other income was associated with the sale of beer bottles and a transfer of funds previously not credited to the recycling program.

Program Economics

A minimal number of costs are charged to the recycling program according to the accounting procedures used at Fort Lewis. Likewise, no credit is given to the program for diverting materials from the waste-stream and thus (at least theoretically) reducing post waste disposal costs. The charges include the following:

1. Charges by DFAE for maintenance of equipment, including vehicles. These charges include labor, parts, and equipment rental.

2. Labor charges for a civil service truck driver to haul glass to the dealer in Seattle (only one such trip has been made).

3. The 20 percent contract management charges levied by DPDO on the sale of certain materials.

4. A reimbursement to the commissary for the corrugated recovered. This practice was conducted through FY77 but was discontinued thereafter.

Most of the costs apparently associated with the recycling program are not charged to it, including:

1. Salaries paid to military personnel assigned to the Recycling Center.

2. Electricity and other utilities used at the Center.

3. Maintenance performed on the Center and warehouse buildings.

4. Equipment rental on the vehicles used to haul materials.

5. Depreciation on fixed equipment (balers). However, the Army does not normally include depreciation in the cost analyses of any program.

Revenues from the sale of recovered materials are credited to a revolving fund. Income in excess of expenditures is transferred to Budget Account 97-F 3860-5191. Funds are withdrawn from this account for environmental projects. Table 11 presents a cost analysis of the Fort Lewis recycling program.

The profits from the recycling program are used for environmental and energy projects as required by Army Regulation 420-47; specifically, an ecology park is being planned and a facility to burn waste oil and recover energy is being constructed. Waste oil recovery is a part of the overall recycling effort at Fort Lewis but has not been included in this report. Profits from FY77 and projected future profits have been committed as follows: ecology park -- $14,775, and waste-oil-burning facility -- $11,471.

Publicity Efforts

Current

Publicity for all aspects of the Fort Lewis recycling program depends primarily on printed material. Articles have appeared in The Ranger, the Post newspaper, and the Daily Bulletin. Recycling brochures have been handed out to school children at Fort Lewis, and handbills have been delivered in the family housing areas. Containers are stenciled with logos, the name of the material each is to contain, and instructions for material preparation.

A variety of methods are used to educate participating personnel. When a supervisor requests that a building be included in the program, Recycling Center personnel deliver handbills and posters applicable for use with the central containers. The Center personnel brief the super-

Table 11

Cost Analysis of Fort Lewis Recycling Program for FY77

Gross Income*	
Corrugated material	$28,919
Glass	1,916
Beer bottles	882
Transfer of funds previously accounted for incorrectly	1,794
	$33,511
Expenditures	
Containers for high-grade paper	$ 1,780
DPDO 20 percent contract management fee on sale of some materials	5,784
Returned to commissary for corrugated**	6,393
DFAE services	9,364
	$23,321
Balance	$10,190

* Reported verbally by Fort Lewis DFAE personnel with a slight ($322) discrepancy when compared to annual report.

** Commissary was reimbursed for corrugated through FY77. This practice has been discontinued.

visor about how the program operates and the types of material to deposit in each container. The building supervisor is responsible for educating the office personnel. It is assumed that group education is accomplished through posters, handbills, and conversation between personnel.

Future Plans

If the program at Fort Lewis becomes mandatory, the Energy Conservation office plans to expand publicity efforts, particularly in office education areas, and is attempting to write into the regulations the requirement for the distribution of desk-top containers to office areas. One of the problems associated with the program in the past has been that the different paper grades were not really defined. As part of the expanded education efforts, these definitions have been written into the regulations. Also under development is a Recycling Check List to be distributed to the IG inspection team for evaluating units and directorates.

Plans are under way to involve troops and children in incentive award programs, e.g., increasing recovery of newsprint, cans, and glass, by having school children bring the materials to their schools. The programs and proposed collection procedures have not yet been finalized. Fort Sill, OK, is currently using a troop incentive award program (known as the RAW Deal Program) to involve troops in the collection of recyclable materials. A similar program is being considered at Fort Lewis.

Observations

Most personnel at Fort Lewis are aware that a recycling program is in effect, as evidenced by the number of people using the central collection points and office containers. However, education programs in office buildings appear to be weak, largely because of the voluntary status of the current program. Contamination is also a problem in office area containers; the central containers should be uniformly and clearly marked with instructions and preferably covered.

Drop-off containers could be identified more clearly; for example, at the Commissary collection point, people depositing material had to search for the appropriate container. This could partially account for the high contamination levels in some of the containers. If the containers were more clearly marked, perhaps with larger stenciled letters and diagonal banding, the contamination problems would probably be reduced.

Summary

The success of the Fort Lewis recycling program--as measured by the amount of materials diverted from disposal (approximately 1000 tons (909 mt) per year -- an estimated 6 percent of the waste generated can be attributed to several factors:

1. The interest of individuals in positions of authority; these people can make facilities, personnel, and equipment available to initiate a program and to stress the importance of participating in the program.

2. The participation of relatively large, though indefinite, numbers of individuals. This was accomplished through publicity efforts.

3. The presence of interested markets.

4. The availability of military personnel to be assigned to the Recycling Center with minimal negative impact on other activities.

5. Inclusion of the corrugated material from the commissary.

The first factor is considered to be the most important in the initiation and success of a recycling program. When this factor is present, the others can virtually be assumed. For a voluntary and relatively informal program, the Fort Lewis system is quite effective in recovering recyclable materials.

Fine-tuning efforts on the overall system will probably (1) increase the numbers of personnel participating (and thus the amount of materials recovered), and (2) reduce contamination levels at the source (by reducing the labor requirements at the Center). Some suggestions for improving the program include:

1. Conducting a market survey to determine the potential interest in the types of materials currently being separated and stored. If no reasonable market for some materials can be found, they should not be collected and stored.

2. Making the separation of high-grade paper in office buildings mandatory (efforts already under way).

3. Using more uniform methods for source separation and storage within the buildings, and conducting organized educational sessions for office workers.

4. Encouraging participation by military units by establishing an incentive program, possibly similar to the one used at Fort Sill.

4 RECYCLING AT FORT SILL, OKLAHOMA

A voluntary recycling program was instituted at Fort Sill in December 1974 and a central collection point and a recycle center processing activity (RCPA) established. Materials collected included:

1. Glass (clear, brown, and green, separated by color)
2. Cans (steel, aluminum, and bimetal)
3. Newsprint
4. Corrugated material
5. Mixed paper.

Under the requirements of the U.S. Environmental Protection Agency's Material Recovery Guidelines (40 CFR 246), the source separation of high-grade paper, corrugated materials, and newsprint became mandatory at Federal installations where such activities were economically feasible (e.g., Fort Sill). To insure maximum participation in the mandatory aspects of the program, recycling was included as an item of interest.

In October 1977, DFAE instituted an incentive program to increase the volume of high-value recyclables (paper grades and aluminum cans). The program provides for the involvement of troops in the collection and delivery of the materials. Named RAW Deal (Recycle and Win), the program awards points to the military units delivering materials to the RCPA. Points are awarded according to the relative value of the material and the amount delivered. Each quarter, the Director of Facilities Engineering (DFAE) awards the unit with the highest number of points an improvement project having a value of up to $5000.

The RAW Deal program has been revised to encourage the competition of smaller troop units. The program is highly publicized and, during the first 6 months of this year, the following quantities of material have been sold:

1. 88 tons (80 mt) of corrugated material (exclusive of commissary and PX programs)
2. 29 tons (27 mt) of computer tab cards

4. 96 tons (88 mt) of white office paper
5. 29 tons (27 mt) of newsprint

The program appears to be functioning well because of its continued high level of support. It is well publicized, and there is anticipation of operating at a profit this year. The program is only breaking even at this time.

Directives and Requirements

Army regulation No. 420-47 issued by the Headquarters, Department of the Army on 9 June 1977, sets forth the standards, procedures, terminology, and responsibility for solid waste management at Army facilities/installations. USAFACFS Circular 420-47 delineated specific requirements for the Fort Sill Recycling Program.

The responsibilities for operating and managing the recycling program at Fort Sill are assigned to the DFAE. Specific control and management of the program at Fort Sill is under the direction of the Environmental Division Chief. Sale of the material collected through the program is the responsibility of DPDO.

Fort Sill Circular 420-47, item 5c., puts the evaluation of the recycling program at the unit or activity level under the auspices of the Inspector General (IG). USAFACFS Cir. 20-1, dated 6 January 1978, includes the program as a special subject for IG inspection. The Environmental Division representative on the IG team is responsible for the unit inspection and for compliance with the program guidelines. The responsibility for participation at the unit or activity level lies with individual Commanders and Directors. They are also responsible for publicizing the program at their levels.

The Circular specifically mandates the source separation of computer printouts, computer tab cards, high-grade paper, corrugated cardboard, newspaper, and aluminum cans. Recycling of wastes, glass, steel cans, and bimetal cans is optional.

Specific source separation collection methods within activities are left to the discretion of the Commanders and Activity Directors, although desk-top and centralized containers are suggested. Except where special recyclable material containers are located at high generation points (i.e., Bldg. 441 [Print Plant], Bldg. 1713 [Package Beverage Store], Bldg. 2192 [Self-Service Supply], Bldg. 2234 [DIO Supply], and Bldg. 304 [ISO Hall], and are hauled by the refuse contractor, each unit and activity must deliver their materials to the Recycle Center Processing Activity (RCPA). The PX and commissary are exempted from participation in the DFAE and corrugated recovery programs since they have their own programs; however, any other recyclables generated by these facilities must be brought to the RCPA. Family housing occupants must separate newsprint and aluminum cans from household refuse for curbside collection.

Development of the RAW Deal Program

Approximately 4 months after Circular 420-47 was issued and distributed, DFAE evaluated the recycling program. Based on original estimates (Figure 13), DFAE determined that only 10 percent of the recoverable quantities of paper and aluminum was actually being recovered and processed. Since the materials brought the highest market prices, it was determined that a publicity/incentive program must be developed to increase recovery rates. Subsequently, an award program known as the RAW (Recycle and Win) Deal Program was developed and initiated. The program was open only to battalions and to the Headquarters Commandant Section. Other military organizations were not eligible for awards.

Battalions were encouraged to segregate and collect recyclables within their unit areas and to seek outside sources of materials, including clubs, off-post housing, offices, and headquarters elements. They were prohibited from collecting at family housing areas where curbside pickup was scheduled, from the Craig Road Collection Point, and from the RCPA warehouse. They could not remove materials from other units or activities without their permission.

Under the program, the six materials required to be recycled under USAFACFS Circular 420-47 were assigned the following point value based on relative market values:

Aluminum cans	30 points per pound
Computer tab cards	15 points per pound
Computer printout	9 points per pound
White paper	6 points per pound
Newsprint	3 points per pound
Corrugated containers	1 point each

"Bonus" points were to be awarded occasionally.

The troops were to collect and bring contaminant-free materials to the RCPA for weigh-in. Receipts for the materials (Figure 14) were given to the driver of the delivery vehicle. Copies of the receipts were retained and tallied by the Environmental Office of DFAE. The Environmental Division representative of the IG team maintained these copies to determine active, continued compliance with recycling guidelines. In addition, copies of receipts from activities not in the RAW Deal Program were retained to determine their levels of interest and compliance.

At the end of the fiscal quarter, the participating troops having the highest point scores were rewarded with a $5000 DFAE project of their choice. The project was to be jointly decided upon by the Director, the DFAE, and the commander of the winning organization. The prize was either a DFAE project which the organization was "in line" for, or new work that would not violate statutory requirements.

NEWSPAPER

POST NEWSPAPER "CANNONEER"

11,000 COPIES/WK X 4 WEEKS/MO X 2.5 OZ/COPY + 16 OZ/LB
= 6,875 LB/MO

LOCAL CIVILIAN NEWSPAPERS

1,400 COPIES/DAY X 24 DAYS/MO X 7 OZ/COPY + 16 OZ/LB
= 14,700 LB/MO (SUNDAY EDITIONS NOT INCLUDED)

AN INESTIMABLE NUMBER OF NEWSPAPERS ARE MAILED TO THE POST OR SOLD THROUGH VENDING MACHINES. TO ACCOUNT FOR THIS, IT WAS ASSUMED THAT 100 PERCENT (RATHER THAN 70 PERCENT) OF THE ABOVE QUANTITIES WERE RECOVERABLE.

TOTAL RECOVERABLE NEWSPRINT = 21,575 LB/MO = 10.8 TONS/MO.

COMPUTER PRINT-OUT*

SOURCE	BOXES/MO. @ 45 LB/BOX	LB/MO
COMBAT DEVELOPMENT	8	360
USAFAS DATA SYSTEM	90	4,050
MISO	607	27,315
SELF-SERVICE	944	42,480
		74,205

TOTAL RECOVERABLE = 0.7 RECOVERY RATE X 74,205 LB/MO + 2000 LB/TON
= 26.0 TON/MO.

COMPUTER TAB CARDS*

SOURCE	BOXES/MO. @ 9 LB/BOX	LB/MO.
MISO	500	4,500
COMBAT DEVELOPMENT	3	27
DA 2765-1	5	25
		4,552

TOTAL RECOVERABLE = 0.7 RECOVERY RATE X 4,552 LB/MO + 2000 LB/TON
= 1.6 TONS/MO.

Figure 13. Original estimates for the Fort Sill recycle program.

MIXED WHITE OFFICE PAPER*

SELF-SERVICE SUPPLY'S MONTHLY CONSUMPTION AVERAGE OF NUMBERS OF CASES OF VARIOUS WHITE PAPERS:

CASES/MO	LB/CASE	LB/MO
353	40	14,120
29	47	1,363
12	49	588
404	30	12,120
182	48	8,736
125	54	6,750
912	61	55,632
2,688	48	129,024
862	96	48,272
66	60	3,960
10	46	460
4	52	208
108	46	4,968
29	34	986
857	40	34,280
		TOTAL 321,467 LB
		= 160.7 TONS

TOTAL RECOVERABLE WHITE OFFICE PAPER = 0.7 RECOVERY RATE X 160.7 TONS/MO = 112.5 TONS/MO

CORRUGATED* (COMMISSARY AND PX NOT INCLUDED)

TWO APPROACHES USED TO ESTIMATE QUANTITIES GENERATED AND RECOVERED FROM TWO SOURCES -- WAREHOUSES AND DINING FACILITIES.

APPROACH NO. 1

722 WAREHOUSE EMPLOYEES X 116 LB CORRUGATED/EMPLOYEE/MONTH + 2000 LB/TON = 41.9 TONS/MO

9000 PERSONS FED DAILY (27,000 MEALS/DAY) IN DINING FACILITIES X 10 LB CORRUGATED/MONTH/PERSON FED DAILY + 2000 LB/TON = 45.0 TONS/MO

TOTAL RECOVERABLE: 41.9 TONS/MO (WAREHOUSE) X 0.7 RECOVERY RATE = 29.3 TONS/MO
45.0 TONS/MO (DINING FACILITIES) X 0.5 RECOVERY RATE = 22.5 TONS/MO
51.8 TONS/MO

Figure 13 (cont'd).

APPROACH NO. 2

THIS APPROACH INVOLVES THE USE OF ASSUMED DAILY WASTE GENERATION RATES, PERCENTAGE OF THE WASTE THAT IS CORRUGATED, A RECOVERY RATE, AND THE NUMBER OF DAYS OF OPERATION PER MONTH.

WAREHOUSES: 11.8 LB OF WASTE/EMPLOYEE/DAY X 722 EMPLOYEES
X 46% CORRUGATED X 0.7 RECOVERY RATE
X 22 DAYS/MO = 60,346 LB/MO
= 30.2 TONS/MO

DINING FACILITIES: 1.0 LB OF WASTE/PERSON FED DAILY X 9,000 PERSONS FED DAILY X 22% CORRUGATED X 0.5 RECOVERY RATE
X 30 DAYS/MO = 29,700 LB/MO
= 14.9 TONS/MO

TOTAL RECOVERABLE CORRUGATED = 45.1 TONS/MO

NOTE: APPROACH NO. 2 YIELDED THE LOWER RECOVERABLE QUANTITY (45.1 VS. 51.8 TONS/MO) AND THUS WAS USED FOR THE INITIAL CONSERVATIVE ESTIMATE.

GENERATION RATES FOR MATERIALS OBTAINED FROM DEPARTMENT OF THE ARMY. SOURCE SEPARATION OF PAPER FOR THE PURPOSE OF RECYCLING: PROPOSED SOURCE SEPARATION PROCEDURES, DAEN-FEU, INCL 1, 23 FEBRUARY, 1977.

Figure 13 (cont'd).

RECYCLABLE MATERIAL RECEIPT
(USAFACFS Cir 420-47)

Unit/Activity .....

Building No. ..... Date .....

	Quantity	Points
Aluminum Cans	.....	.....
Punch Cards	.....	.....
Computer Printouts	.....	.....
High-grade (white) Paper	.....	.....
Newspaper	.....	.....
Corrugated Cardboard	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

The above material was delivered this date to the Recycle Center Processing Activity, Bldg 3328, Fort Sill, OK.

Received By: .....

Delivered By: .....

FS Form (DFAE) 434
1 Oct 77

7710-3815 Army-Fort Sill, Okla. 3M

Figure 14. Recyclable material receipt.

In January 1978 the RAW Deal Program was modified to further improve recovery rates and to broaden participation. Although early FY78 tonnages of paper and aluminum had increased, high-grade paper recovery was still less than anticipated. Also, smaller troop units and late starters in the RAW Deal Program were overwhelmed by the point scores attained by the larger units, with some units not participating (Table 12). To provide incentive for the smaller units, the program was restructured into two Divisions, with the command elements and larger troop units separated from supported battalions (Table 13). Each participant within each Division competed as a separate entity, and the incentive award was presented to the winner from each Division.

Directorates and other staff elements not eligible for the RAW Deal Program were encouraged to contribute material for the competition. To maintain the IG evaluation of the programs from the nonRAW Deal participants, the RCPA receipts were altered to list both the source of the material and the unit delivering the material. The revised program is now in effect.

Material Recovery

Material is recovered at Fort Sill by any one or combination of several methods shown in Figure 15, including:

1. Craig Road Collection Point

2. Recyclable material containers located at high generation points throughout the installation

3. Individual building involvement

4. Troop involvement through the RAW Deal Program

5. RCPA collection from family housing areas.

Craig Road Collection Point

When the voluntary recycling program began in 1974, a central collection point for depositing recyclable material was located in the Main PX parking lot. When space limitations interfered with collection activities, the central collection point was moved to its current location on Craig Road near the Main PX and commissary. The original equipment is still used and consists of eight 8-cu-yd (6 m^3) lugger containers designated for the collection of clear, brown, and green glass; aluminum, bimetal, and steel cans; mixed paper; and refuse. In addition, two 40-ft (12-m) enclosed semi-trailers are designated for the collection of corrugated cardboard and newsprint. The newsprint trailer is locked to discourage children from playing in it and because the mandatory program allows for the curbside collection of the material. Three metal cans

Table 12

Participation in the Early RAW Deal Program

RAW Deal Point Scores
1st Quarter FY78

HQ, 75th Group	418,940
14th Aviation Battalion	303,951
HQ Commandant Section	131,111
100th S&S Battalion	67,941
1/17th FA	44,472
3/9th FA	30,448
2/18th FA	16,624
3/18th FA	16,471
2/1st FA	11,015
2/36th FA	10,441
4/31st INF	8,003
1/12th FA	7,980
HQ,ATC	6,736
HQ, 212th Group	5,996
HQ, III Corps Arty	5,090
HQ, USAFAS	5,067
299th Engineer Battalion	4,789
2/37th FA	4,624
HQ, MEDDAC	4,180
Officer Student Battalion	3,780
4/4th FA	3,627
2/12th FA	3,586
2/34th FA	3,407
Training Command Battalion	3,215
6/33d FA	3,172
Staff & Faculty Battalion	3,071
Specialist Training Battalion	2,466
HQ, 214th Group	1,083
HQ, 9th Msl Group	954
1st Cannon Training Battalion	625
3d Cannon Training	615
FAMSEG	312
4th Basic Training Battalion	280
2d Cannon Training Battalion	0
5th Composite Training Battalion	0
2/2th FA	0

Table 13

Current Participating Groups in the RAW Deal

Division I for RAW Deal

HQ, III Corps Arty
HQ, FAM Group Number 9
HQ, 212th Arty Group
HQ, 75th Arty Group
HQ, 214th Arty Group
HQ, MEDDAC
HQ, Commandant Sec USAFACFS
100th S&S Battalion
HQ, USAFATC
USAFAB
USAFAS BDE

Division II for RAW Deal

1/12th FA
3/9th FA
6/33d FA
2/12th FA
2/18th FA
2/37th FA
3/18th FA
1/17th FA
2/34th FA
2/36th FA
4/4th FA
Staff and FAC Bn
Officer Student Bn
299th Engr Bn
1st Cannon Tng Bn
2d Cannon Tng Bn
3d Cannon Tng Bn
4th Basic Tng Bn
5th Composite Tng Bn
Specialist Tng Bn
2/1st FA
2/2d FA
4/31st INF
14th Avn Bn
Tng Command Bn

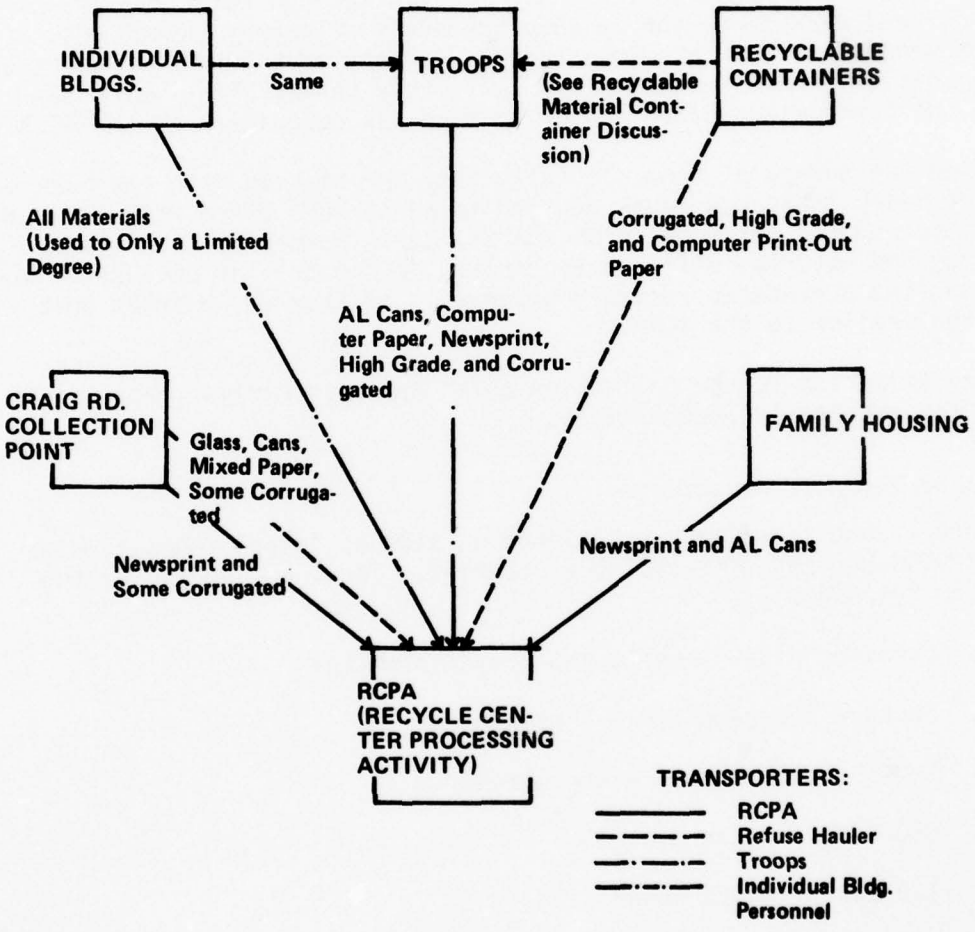

Figure 15. Flow diagram of material recovery methods at Fort Sill.

located on a deck between the two trailers are now marked for newsprint collection.

All containers and trailers were decorated by local Girl Scouts at the inception of the voluntary program to distinguish them from refuse containers. In addition, DFAE stenciled instructions for material deposit on each container and clearly marked the area with signs that explain its function.

Material is brought to the Craig Road Collection Point by Fort Sill personnel and dependents and by some residents of nearby Lawton, OK. RCPA personnel monitor this area and other containers for recyclables on a daily basis. When a container is full, they notify DFAE, which notifies the contracted refuse hauler to take the containers to the RCPA.

When the newsprint cans are full, they are emptied into the back of the RCPA 1-ton stake bed truck and are taken to RCPA along with low volumes of corrugated cardboard from the trailer. Normally, high volumes of corrugated material will not accumulate in the trailer because of the other ongoing corrugated recovery programs. If they do, a troop unit hauls the trailer to the RCPA.

Contamination at the collection point has been minimal because the containers are easily identifiable.

Recyclable Material Containers

Lugger containers were positioned outside buildings identified as concentrated sources of recyclable material. The DFAE identified the following buildings:

1. Printing Plant - white paper and trimmings
2. Package Beverage Store - corrugated
3. Self-Service Supply - corrugated
4. DIO Supply - corrugated
5. ISO Hall - white paper

Standard 8-cu-yd lugger containers are used at all locations except the printing plant where a funnel-like feature was added to facilitate the loading of paper trimmings. During daily monitoring rounds, RCPA personnel note which containers are nearly full and inform DFAE, who notifies the contracted hauler. A record is kept at RCPA of the dates on which each container is emptied, thus providing insight on generation rates, fluctuations, and contamination sources.

Individual Building Involvement

The USAFACFS Circular 420-47 requires mandatory recycling of most paper grades and aluminum cans installation-wide. Commanders and Activity Directors at all levels are directed to "insure that maximum participation by all personnel is attained." Individual Commanders and Directors are responsible for identifying any techniques which are practicable, including desk-top containers, special wastebaskets for high-grade paper, centrally located cartons for computer printouts, plastic bags, and conspicuously marked covered barrels for aluminum cans. The techniques used for source separation vary. Several representative individual buildings were visited to determine their arrangements for source separation and collection activities.

Building 1651, Finance and Accounting. Military pay records and other accounting activities are housed in Building 1651. Currently, computer printouts and tab cards are separated and saved within offices. Boxes (provided by MISO) are located alongside employee desks in central locations to collect computer printouts. Computer tab cards are collected in their original boxes and stacked in a central location.

Personnel financial records are maintained within this building. Once a month, 19,000 individual files are searched and records more than 18 months old are deleted. Since bulk disposal of such material is no longer a violation of the Privacy Act, the high-grade paper from these files can now be source-separated in bulk and then shredded at the RCPA. A box is located next to the employee's desk to collect this material. These boxes are emptied or deposited at a central point. Carbon paper contamination is currently a problem. Approximately 5 tons of computer printout and tab cards are generated within the building every 3 weeks.

Troops participating in RAW Deal transport the separated paper and cards from Building 1651 to the RCPA. The specific troop unit collecting and getting credit for the material depends on the unit's ability and interest in "recruiting" the building. A troop unit may visit a building and ask for the paper. If no other unit is collecting it, the Activity Director may give his approval and that unit is expected to remove the separated paper periodically. The Activity Director may contact the troop unit if the central containers need to be emptied. The DFAE has encouraged Activity Directors to not give "long-term franchises" on a building's recyclables, but to change from one troop unit to another every few months.

Education about the recycling program began when the Activity Director received Circular 420-47. He then discussed with the Branch Chiefs what types of materials could be recovered. The Branch Chiefs notified the supervisors who informed their employees of the program, educated them, and provided containers for source separation.

The collection and education activities within this building were representative of procedures for most large buildings at the installation. However, no uniform approach to employee education has been used at Fort Sill. Much of the education is and has been word of mouth and tradition. Overall, the approach to building and personnel involvement in recycling can be characterized as fairly effective and very informal. This is exemplified by the fact that an exact listing of participating buildings and the number of employees within each building could not be obtained.

Building 1950, Directorate of Facilities Engineering. Civilian directorates such as DFAE are not eligible for the RAW Deal incentive program, but their recycling activities are reviewed under IG inspection. Within Building 1950, aluminum cans, high-grade paper, and computer printout are saved. Improvised desk-top containers are used in some locations, but generally central cardboard boxes are used. The material from this building is given to troops in the RAW Deal program on a first-come, first-served basis. Generally, the directorates are most often approached by troops for recyclables on a weekly basis.

Building 1719, Commissary Store. The commissary at Fort Sill, which generates approximately $2 million per month in sales, has been involved in its own corrugated recycling program since 1976. In addition, computer printout, tab cards, and aluminum and bimetal cans are source-separated for the post-wide DFAE program.

Corrugated Program. Figure 16 is a sketch of the commissary layout. Deliveries are made to the commissary loading dock through any of eight doors. Eight to nine forklifts are available within the commissary to move the material to shelves for storage. Cartons of food from the stock storage are moved by hand carts to a conveyor belt and box cutter where the tops and fronts of the cartons are removed. Box trimmings are collected in a cart and put into the adjacent baler. As the baler fills with corrugated material, available personnel will compact it. When enough corrugated has accumulated to complete a bale, available stockroom personnel tie it, load it on a forklift, weigh it to insure that each bale weighs at least 500 lb (230 kg), and deliver it to the loading dock. Each bale is tagged with its actual weight. When two bales accumulate on the dock, a forklift loads the bales onto the commissary's own 3/4-ton (0.68-mt) pickup truck. The bales are then hauled across the street to a commissary warehouse with adjacent railroad siding. Approximately three 600-lb bales are generated daily, 5 days per week.

When approximately 250 to 270 bales accumulate (three boxcar loads every 2 months), the commissary notifies DPDO to offer a spot sale for the material. The commissary had contacted DPDO concerning the possibility of obtaining a term contract for the corrugated. However, at that time the highest offer was for only 20 percent of the market price which amounted to only $8/ton ($8.80/mt). Consequently, the spot sale

approach was preferred and is currently averaging approximately $44 per ton. For the first half of FY78, approximately $2700 in revenues have been received from the program (after PDO's 20 percent is deducted) for 75 tons (68.2 mt) of material, or a net revenue value to the commissary of approximately $35 per ton ($38.50/mt).

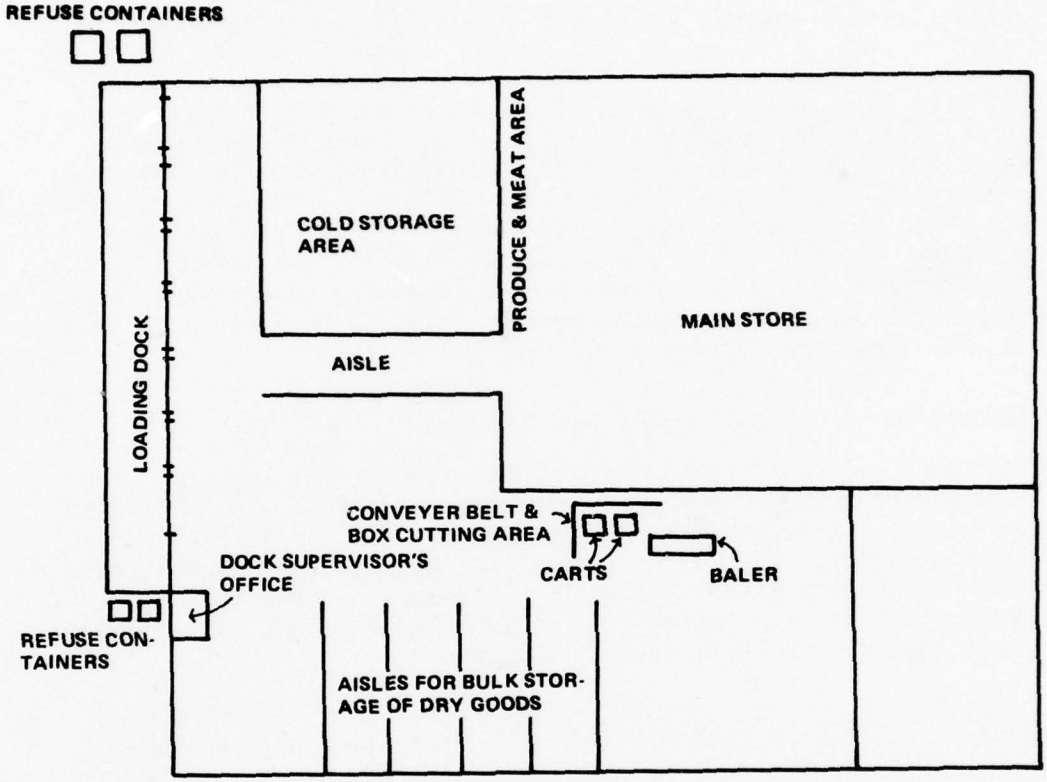

Figure 16. Fort Sill commissary layout.

Revenues from the sale of corrugated are deposited within the commissary surcharge account under a special "scrap cardboard, troop support agency account." This is a revolving fund separate from other surcharge revenues. The fund is used to pay recycling operational costs for equipment, utilities, etc.

The commissary's current corrugated recovery operations are satisfactory; no additional labor is required to perform the program and it does not interfere with ongoing activities. Contamination does not appear to be a problem, since the four refuse containers are conveniently loaded near the loading dock and are hauled regularly by the refuse contractor.

Computer Printout, Tab Cards, and Aluminum and Bimetal Cans. Approximately 30 personnel are involved in the commissary office operations. Central containers are labeled for computer printout and tab

cards are stacked in their original boxes in a central location within each office. Containers are labeled near vending machines for deposit of aluminum cans. The commissary messenger service takes the material to the RCPA once a week. Since the messenger is already in the area, no excess charges are incurred. On the average, the commissary produces 100 lb (45 kg) per month of recyclable tab cards; 4501 lb (2000 kg) per month of computer printout, and sporadic quantities of aluminum or bi-metal cans.

Building 1712, Main Exchange. The Main Exchange at Fort Sill does not participate in the DFAE recycling program. However, waste corrugated is baled as part of a recycle program within the Army/Air Force Exchange System. Corrugated from the Main Exchange is baled into 500-lb (230-kg) bales which are backhauled daily at a rate of two per day, 7 days per week, to the central warehouse facility in Fort Worth, TX. Revenues from the sale of material are credited to a Headquarters Account 795-05, Miscellaneous Income-Salvage Income. Main Exchange sales at Fort Sill gross approximately $300,000 per month.

Troop Involvement Through the RAW Deal Program

Thirty-six military units are participating in the RAW Deal program. An environmental coordinator has been identified within each of the participating troop units on a battalion level. This is an extra duty responsibility. The coordinator is responsible for educating and promoting the program within the unit. Troops participating in the RAW Deal program obtain recyclables from (1) within their own batteries and staff sections, and (2) from outside sources.

Battalion Batteries and Staff Sections. Some coordinators have published standard operating procedures concerning separation and collection methods for the program; others use an informal, word-of-mouth approach. Generally, if a standard operating procedure is published, it is posted on the bulletin boards of each Battery and Staff Section within the Battalion.

Separate receptacles are established within day rooms, orderly rooms, and office areas to collect the appropriate materials. Requirements differ, but generally materials from all units and sections are brought daily to a central troop collection point within the building (usually a day room), where contaminants are removed and any extra source separation is accomplished.

On designated collection days, two personnel within the unit are assigned the extra duty of collecting from buildings within the battalion complex. The RCPA is contacted and advised that the battalion is making its collection run and will deliver the materials. This assures that RCPA personnel will be available to receive the recyclables. Next, the person responsible for the recycling program and central containers in each building is contacted and advised that the collection crew is on

its way. This person checks through the materials for contamination or missegregation and prepares the materials for the collection crew.

Two personnel using a truck assigned to their unit from the motor pool collect the recyclables. The method of storage on the truck and the equipment can vary. These personnel check the material to insure that no contamination is present. If the material has not been properly segregated, it will be returned to the individual responsible for the building's central collection point.

After completing the collection rounds, the crew hauls the material to the RCPA. There the material is checked for contaminants, weighed, and a receipt given to the truck driver. If the material is contaminated, the RCPA will not accept it and will request that the troops either remove contaminants on the spot, or take the material back to their areas and resegregate it.

Outside Sources. Outside sources include essentially all activities at Fort Sill and outside one of the eligible military units. Examples are the DFAE and other directorates, buildings housing office-type operations or computer activities, and even the roads and grounds throughout the installation. The environmental coordinator in each participating unit encourages troops to recruit as many sources as possible.

RCPA Collection Activities

Newsprint and aluminum cans are collected separately from the family housing areas. Each area receives this service twice a month and on the same day as regular refuse collection. Residents are notified through the Daily Bulletin about when the collections are scheduled. Materials are put at curbside along with the refuse. Newspapers must be bundled or bagged, and cans must be in bags. Troops may not collect materials in the housing areas for RAW Deal points.

Material Processing

RCPA Equipment and Personnel

In December 1974, when a voluntary recycling program was in effect at Fort Sill, the Recycle Center Processing Activity was located within Building No. 214. At that time, the following equipment was acquired for the recycling effort:

1. An excessed vertical downstroke baler obtained by DFAE from another Army installation for a shipping cost of $1200. The baler was used to bale the paper into 600- to 800-lb (270- to 360-kg) bales.

2. A glass crusher, pieced together from an old, reconditioned feed mill.

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IMPLEMENTATION OF RESOURCE RECOVERY GUIDELINES AT FORT MEADE, F--ETC(U)
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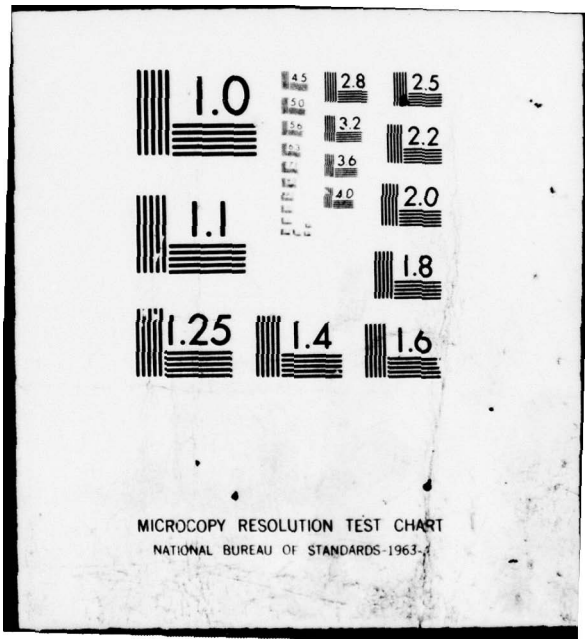
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3. A 4000-lb (1800 kg) forklift, was obtained at no cost to DFAE as excess equipment from the closing of Fort Walters. In addition to moving materials, it was used to flatten cans.

4. An overaged 3/4-ton (0.68-mt) truck, taken from salvage.

5. Several 55-gal (208.2-l) drums, pallets, and large boxes, obtained from the DPDO yard.

In 1977, Building No. 214 was redesignated for a training activity. The Recycle Center Processing Activity was moved to Building 3328, its current location. The following equipment was added to the new facility:

1. A 2000-lb (900-kg) forklift, borrowed as excess equipment from another activity on-post. It was eventually transferred to the RCPA as permanent equipment.

2. A can processor (flattener).

3. A shredder-baler, purchased by DFAE for $30,000, to handle the anticipated excess volume of paper. The funds came from year-end money allotted to DFAE by TRADOC.

4. A 1-ton (0.91-mt) stake-bed truck borrowed on a standing commitment from the Motor Pool. It is signed out on a daily dispatch, and is used to collect from the housing areas and Craig Road Collection Point.

5. A dirt-floor warehouse (Building 3337) for processed material.

Personnel currently assigned to the RCPA include:

1. Three military personnel (temporary) including one E-7, one E-4, and one E-3.

2. Two temporary civilian personnel, both WG-2. The foreman of the RCPA is one of these.

3. One part-time student aide who works 1144 hours per year.

RCPA Operating Procedures

The RCPA receives material from 0800 to 1400, every Monday through Friday, except holidays. All material brought to the RCPA is dumped or placed inside the receiving doors. Specially constructed receiving doors were specified when the building underwent renovation to accommodate the additional height needed for the refuse hauler to empty lugger containers. Figure 17 shows the layout of equipment and storage areas in the RCPA.

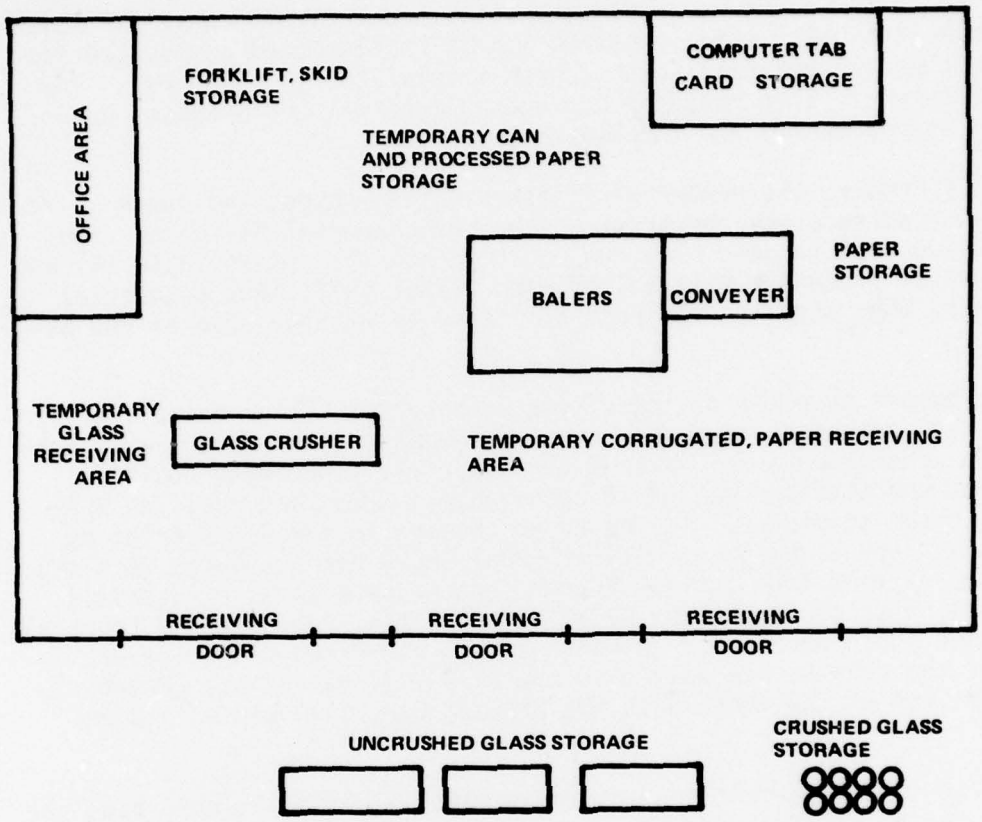

Figure 17. Recycle center processing activity (RCPA) layout.

After delivery, the material is moved manually or by forklift to the appropriate processing area. Glass (separated by color at the source) is shoveled or dumped into the crusher. The crushed glass falls to the floor. It is then shoveled into steel drums (separated by color). Drums of crushed glass are stored outside the RCPA. Temporary storage of uncrushed glass outside the RCPA is in trough-like metal containers.

Previously, cans were spread on the concrete floor of the RCPA and flattened by driving a forklift over them. The cans were then shoveled into heavy corrugated boxes. Since delivery of the can smasher, flattened cans are automatically conveyed into the boxes.

Paper is pushed to the conveyor, which feeds it into the shredder/baler. The paper is then manually placed on the conveyor and the few remaining contaminants removed. As bales are completed, they are moved by forklift to temporary storage within the RCPA or taken directly to the nearby warehouse. High-grade, computer printout and newsprint are baled separately into 700-lb (320-kg) bales. Computer tab

cards in 9-lb (4-kg) boxes are loaded into the vertical downstroke baler and banded with baler wire. These bales (with flattened corrugated forming the tops and bottoms) weigh approximately 2200 lb (1000 kg). The vertical baler is also used for corrugated material and produces bales weighing approximately 750 lb (340 kg).

Every Friday, the number of finished bales, boxes, and drums is reported and the receipts forwarded to the Environmental Division. The receipts are used to determine the monthly recovery rates (Table 14) and the amount of processed material on hand. When sufficient quantities accumulate, DFAE notifies the Fort Sill DPDO to arrange sale of the materials.

All buyers have the option of moving material either by rail or by truck. RCPA personnel load the buyer's conveyance, but buyers must make their own arrangements for hauling the material. The buyer notifies DPDS about the time and method of conveyance. DPDS then notifies DFAE 72 hours prior to pickup. If the buyer chooses to remove material by truck, the truck is weighed empty at DPDS. RCPA borrows 5-ton (4.5-mt) trucks and drivers from a troop transportation unit to move materials from the RCPA warehouse to the DPDS loading docks. The buyer's truck(s) are weighed again when full. A weigh ticket and receipt are issued. Copies of the receipt are mailed to the DPDS Regional Office (Memphis, TN) at the end of the month when the DPDS at Fort Sill closes its accounts.

If the contractor chooses to remove material by rail, RCPA uses the borrowed trucks to transport the material, and delivers it for loading onto boxcar(s). The gross, tare, and net weights are calculated at the DPDS scales for each truckload until the boxcar(s) is full. A weight ticket for each trip and a weigh tally are made. When the material is loaded, the boxcar(s) is sealed. The buyer's representative comes to DPDS to sign the receipt, and the paperwork is processed as for truck removal.

RCPA recently constructed a loading dock at the warehouse which will allow the direct loading of contractors' trailers from the warehouse. This will eliminate having to borrow trucks when the contractor chooses to remove material by truck. Because of a manpower shortage at the RCPA, the building is now required to shut down on the days that the material is being loaded onto dealers' conveyances. The loading process requires from 4 to 6 hours, depending on the method. For this reason, RCPA requests that all materials being delivered to the building be preceded by telephone notification.

Table 14

FY78 Monthly RAW Deal Totals at the RCPA (Pounds)

MONTH	CORRUGATED MATERIAL *	NEWS-PRINT	HIGH-GRADE PAPER	COMPUTER PRINT-OUT	TAB CARDS	ALUMINUM CANS	BI-METAL CANS
OCT 77	800	325	4595	8794	1335	384	270
NOV 77	5877	3182	17234	27686	6824	1339	873
DEC 77	5242	5324	30810	15712	3780	2217	1746
JAN 78	7559	4904	19722	2242	12354	2032	1268
FEB 78	7843	2739	20694	16911	5302	1854	784
MAR 78	11885	5531	23364	23824	10397	2594	1450
RAW DEAL TOTALS TONS	19.6	11.0	57.8	47.5	19.9	5.2	3.2
FT. SILL TOTALS TONS **	129	29	95.7	112	28.6	5.2	3.2

* Figures for corrugated indicate the number of cartons delivered to RCPA in the Raw Deal Program. Corrugated is not weighed for points. Totals for corrugated reflect tonnage collected through Raw Deal.

** Ft. Sill totals include materials from all sources including family housing, the Craig Road Collection Point, and other sources in addition to the materials recovered through Raw Deal.

Material Marketing

Market Determination

Most military installations rely on a Regional Defense Property Disposal Office to identify potential markets for excess property. This apparently was the case at Fort Sill when the voluntary recycling program was begun; however, this could not be confirmed. Currently, the DPDR performs this function for the recovered materials. Local markets have been identified by the Chief of Environmental Division DFAE and by DPDS personnel.

When an Invitation for Bids (IFB) is issued, copies are sent to markets on a DPDR mailing list. Extra copies of the IFB are sent to the DPDS office at the installation having the excess property for distribution to other local markets. This approach is being used at Fort Sill to sell recovered materials.

Term Contracts. There are only two term contracts at Fort Sill: one for corrugated cardboard (World Recycling, Lawton, OK), and one for newsprint (Oklahoma Papermill Supply Co., Oklahoma City, OK). Both are annual, term contracts.

The procedure for obtaining markets is similar to that at other Army installations, and involves the DPDO. DFAE furnishes a request to the DPDS for a contract or one-time sale of material on hand. If a contract is requested, DFAE must furnish an estimated annual generation quantity of material, the minimum quantity requested for pickup by the contractor, the fund citation number, and any handling requests. Fort Sill requests that 72-hour notice be given prior to the scheduled pickup of material to allow time for RCPA to borrow the trucks and drivers needed to move the material to the loading area.

DPDA then mails this request to the Regional Defense Property Disposal Office in Memphis, TN, and asks that this information be included as a catalog item to be put in an IFB. DPDR determines how and when they will catalog the item(s) for sale and put them within an IFB.

An interested market fills out the bid portion of the IFB and includes a check (deposit) for 20 percent of the annual anticipated material generation rate times the current market price for the material. This is a "good faith" deposit which is held by DPDR if the firm is awarded the contract.

Sealed bids are opened at DPDR on the date indicated in the IFB. DPDR makes the selection but validates the choice with DLA DPDO Headquarters in Battle Creek, MI, prior to notification of award. The contract is awarded and DFAE receives the notification of award. This process requires 2 to 6 months.

Prices paid in term contracts for recyclable material are usually based on monthly market prices, with contractors paying a percentage of the market price during the month when transfer of property is made.

DPDR notifies local DPDS officers of market prices affecting contracts at their installations.

At Fort Sill, the contractor is given written notification that an appropriate quantity of material is available. This begins when RCPA personnel inventory the material each Friday. DFAE is notified by telephone, and a letter is sent to DPDS, who notifies the contractor by letter. While this formal approach is effective, other programs rely on only a telephone contact between the equivalent of the RCPA and the contractor to request material pickup.

Copies of the receipt obtained from the contractor when the material is loaded are sent to DPDR at the end of the month when DPDS closes out its accounts. DPDR bills the contractor and notifies DPDS. The billing price is made on the prearranged percentage of the market value on the billing date, not on the date of pickup. Market prices are determined from Memphis market listings. Currently, World Recycling is paying Fort Sill at 90.4 percent of the market value for corrugated. Newsprint is currently contracted and sold at 111 percent of its market value. This provides an average of approximately $60 per ton ($66/mt) for newsprint and $39 per ton ($42.90/mt) for corrugated.

Theoretically, the contractor must pay for material within 15 days of its receipt. However, this time may be extended up to an additional week or two, depending on how long DPDR takes to send him/her an invoice. The contractor sends a check to the DPDR which notifies Fort Sill DPDS that payment has been made. DPDS retains 20 percent of the amount paid for contract management and credits the DFAE fund citation with 80 percent. The process from notification for pickup to the time when funds are credited to DFAE can take from 2 to 6 months.

One-Time Sealed Bid Contracts. Other materials offered for sale at Fort Sill usually are marketed in one of two ways; a one-time sealed bid or a one-time spot sale. A one-time sealed bid is a competitive bid for a defined quantity of material, all of which is sold at one time. It is offered for sale in much the same manner as a term contract sealed bid, except that DPDR merely opens the bids, records them, and sends them to DLA, DPDO Headquarters in Battle Creek, where the awards are made. The dealer must submit a 20 percent deposit with his/her bid. When the award has been made and the dealer notified, DFAE requests 72 hours notice prior to pickup. In this instance, however, the dealer must furnish DPDS or DPDR with the remaining 80 percent of his/her bid price which must be paid before the material can be removed. The contractor must pay this money and pick up the material within 20 days or DPDS will add on storage charges. This process usually requires an average of 6 months. All material not sold under term contract is marketed through one-time sealed bids.

One-Time Spot Sale. The one-time spot sale is an auction of materials at DPDS to local interested dealers. This method is used only if warehouse space limitations require that a quantity of material be dis-

posed of quickly without the advantage of a sealed high bid. The only spot sale ever used at Fort Sill was for a small amount of bimetal cans which could not be sold by any other method.

Generation Rates and Revenues

Figure 18 shows the tonnages and revenues obtained from DPDS during a calendar year.

Problems have been encountered in the sale of bimetal cans and glass. Although markets have been identified for aluminum cans, sufficient quantities are not being obtained to sell on a regular basis, mainly because Coors Beer is offering 17 cents per pound ($0.37/kg) for this material in downtown Lawton, OK. Since there appears to be some pilfering at the Craig Road Collection Point, some of the troops would rather deliver their aluminum cans to Coors for the monetary return. To combat this, some of the troop units involved in the RAW Deal program have offered their own incentives to get the material to the RCPA, including award of a 3-day pass to a soldier bringing in 100 lb (45 kg) or more of total recyclables, including a specified amount of aluminum, during the quarter.

Although glass is still saved, previous attempts to identify a market for it through DPDS failed to locate a dealer who would come to Fort Sill to pick it up. Instead, DFAE had to borrow trucks and drivers to haul the material to Ada, OK, where it was sold at the dealer's yard for $20 per ton. DFAE is attempting to develop a local market for glass. DOD implementation of container deposit programs will enhance recovery and marketing of glass and aluminum cans.

Bimetal cans are virtually unmarketable in the quantities generated at Fort Sill, but are being saved in case a market does develop. They take up little room in the warehouse.

Program Economics

The economics of recycling are often extremely difficult to verify or justify. This is particularly true at military installations where military personnel are assigned to a recycling program. Gray areas include:

1. Should military pay be charged against the program even though the troops would be paid if they were not working at the RCPA?

2. How much, if anything, should be credited to the recycling program for diverting materials from the waste stream, thus reducing disposal operations and landfill space requirements?

3. What accounting should be made of "excess" equipment borrowed, etc., for use at the RCPA?

CY77 FORT SILL RECYCLING PROGRAM

SALE NO.	MATERIAL	QUANTITY ADVERTISED	DATE SUBMITTED	DATE OF SALE (IFB)	BUYER	SELLING PRICE (TON)	QUANTITY SOLD (TONS)	TOTAL FUNDS	AMOUNT TO PDO	AMOUNT FT. SILL	DATE FUNDS RECEIVED
31-7074	Computer paper	40 tons	1 Sep 76	14 DEC 76	OK Papermill	10,506	33.1	355,200	71,040	284,160	15 MAR 77
31-7074	Mixed paper	20 tons	1 Sep 76	14 Dec 76	OK City, OK	1,205	23.6	28,435	5,657	22,743	15 Mar 77
31-7074	Cardboard	20 tons	6 Oct 76	14 Dec 76	Sunbright	1,249	20.4	25,484	5,097	25,484	15 Mar 77
31-7114	Cardboard	20 tons			Waco, TX	1,273	18.5	23,555	4,711	18,940	13 Mar 77
					OK Papermill						
					OK City, OK						
					OK Papermill						
					OK City, OK						
31-7191	Aluminum cans	15 tons	14 Dec 76	12 Mar 77	Panuck ??	(lb) 11	(lb) 1,248	13,724	2,746	10,982	9 Dec 77
					Lawton, OK						
31-7343	Cardboard	60 tons	1 Mar 77	19 Jul 77	Pkg Conn	3,650	49.6	180,931	36,186	144,745	21 Feb 78
31-7343	Newspaper	40 tons	1 Apr 77	19 Jul 77	Kansas City	4,792	40.2	192,696	38,537	154,148	21 Feb 78
31-7343	Mixed paper	20 tons	1 Apr 77	19 Jul 77	OK Papermill	1,531	22.8	34,963	6,994	27,974	21 Feb 78
31-7343	Computer paper	40 tons	1 Apr 77	19 Jul 77	OK City, OK						
31-7343	Books	25 tons	1 Apr 77	19 Jul 77	OK Papermill	2,469	24.9	61,255	12,250	43,004	21 Feb 79
					OK City, OK						
					Withdrawn						
					N. Blockman						
					Memphis, TN						
31-7440	Newspaper (contract)	120 tons	5 Jun 77	1 Sep 77	OK Papermill	11% MXT					
31-8008	Punch cards	9 tons	8 Jul 77	6 Oct 77	OK City, OK	12,888	9.7	125,271	23,054	100,217	23 Jan 78
31-8008	Cardboard	40 tons	9 Jul 77	6 Oct 77	Sunbright	4,152	42.6	176,792	35,358	141,434	23 Jan 78
31-8008	Computer paper	77 tons	8 Jul 77	26 Oct 77	Waco, TX	7,124	86.1	613,522	122,704	490,818	22 Jan 78
31-8073	Cardboard	40 tons	29 Jul 77	23 Nov 77	OK Papermill	3,903	30.0	117,090	22,418	93,672	
					OK City, OK						
					OK Papermill						
					OK City, OK						
					??????						
					Lautun, OK						

Figure 18. Tonnages and revenues from CY77 recycling program.

31-8073	Mixed paper	40 tons	29 Jul 77	22 Nov 77	????	4,187	30.8	129,105	25,821	103,284	
31-8033	Punch cards	9 tons	29 Jul 77	22 Nov 77	????	13,001	9.0	117,009	23,402	93,607	
31-8013	Cardboard	40 tons	31 Aug 77	22 Nov 77	World Recycling	3,703	34.9	136,000	27,216	108,872	16 Feb
34-8023	Punch cards	9 tons	31 Aug 77	22 Nov 77	Lawton, OK	13,001	9.9	127,490	25,578	103,592	10 Feb 76
31-8063	Cardboard (contract)	300 tons	27 Sep 77	1 Dec 77	World Recycling Lawton, OK World Recycling Lawton, OK World Recyling Lawton, OK World Recycling Lawton, OK	91.4% MXT					
31-7440	Newspaper	(Item 11)	26 Sep 77	7 Oct 77		4,436	13.5	59,896	11,977	47,917	15 Dec 78
31-8062	White paper	40 tons	4 Oct 77	21 Dec 77	Southern Papermill	3,765	33.9	127,780	25,556	102,224	
31-8062	Computer paper	40 tons	4 Oct 77	21 Dec 77	????	5,855	25.9	151,762	30,352	121,410	
31-8091	Glass	30 tons	2 Nov 77	24 Jan 78	OK Papermill						
31-8091	White paper	40 tons	2 Nov 77	24 Jan 78	OK City, OK Imperial Paper St. Louis M.P.	5,751	31.0	178,379	35,669	140,671	
31-7440	Newspaper	(Item 11)	30 Nov 77	27 Dec 77		6,633	9.3	61,672	12,334	49,338	24 Feb 76

Figure 18 (cont'd).

4. Should utilities be charged against the program even though the RCPA is not metered?

The approach to cost accounting used in this report to evaluate the economics of the Fort Sill recycling program charges a minimum amount of expenses to the program, but does not credit the program with diverted disposal savings. Specifically, cost items are handled as listed below.

Items Charged as Cost to Recycling Program

1. Salaries for all civilian employees at the RCPA.

2. Maintenance costs for all fixed equipment used at the RCPA, including glass crusher, balers, and scales.

3. Rental (operations and maintenance) costs for mobile equipment assigned to the RCPA, including stake-bed truck and forklifts.

Items Not Charged as Cost to Recycling Program

1. Salaries paid to military personnel assigned to the RCPA.

2. Electricity and other utilities used at the RCPA.

3. Maintenance performed on the RCPA and warehouse buildings.

4. Any additional charges the refuse hauler added to his/her contract bid to haul the recycle lugger containers to the RCPA.

5. Depreciation on fixed equipment (e.g., balers). However, the Army does not normally include depreciation in cost analyses of any program.

Table 15 relates the cost/revenue data for the program. It shows an annual profit of more than $27,000.

Money from the sale of material is credited to DFAE fund citation 21F3875.0111. Reimbursables such as RCPA civilian salaries and maintenance and operation charges on equipment can be drawn from this fund. If funds are insufficient to pay out these reimbursables, money is transferred from the DFAE refuse collection fund citation.

Profits from the recycling program are to be spent in a specified manner. Army Regulation 420-47 specifies that if there is an annual profit of up to $50,000 from the program, it can be used by DFAE for environmental enhancement at the recommendation of the Director. If the profit exceeds $50,000, the balance above $50,000 must be turned over to DPDS where it is put into a clearing account.

Table 15

Cost Analysis of Fort Sill Recycling Program
1 October 1977 through 31 March 1978

Proceeds from sale of material		$24,760
Expenditures		
Civilian salaries	$7,960	
Mobile equipment operation and maintenance	2,060	
Maintenance and Supplies	1,000	
		$11,020
Profit		$13,740
Annual Profit		$27,480

Money drawn from the fund citation cannot be used to purchase new equipment; it can only be used to replace existing equipment. New equipment must be requisitioned under separate regulations and a work request submitted.

Publicity Efforts

The recycling program at Fort Sill has been highly successful and well publicized because of the continued interest and support of the DFAE.

The majority of the initial and continuing publicity is through articles in the Cannoneer and the Daily Bulletin. Articles in the Cannoneer have announced the program and its success. Publicity of the RAW Deal program has boosted interest by reporting the winning organization and the amounts of material recycled. Much of the publicity on RAW Deal is generated within the participating units. This includes standard operating procedures, posters, and talks. The Daily Bulletin is used to remind housing area residents of the pickup schedule for newspapers and cans.

The success and unique aspects of the Fort Sill program have attracted the attention of other news media. Articles have appeared in the Washington Post and the Army Times. In addition, the Chief of the DFAE's Environmental Division has been interviewed on ABC radio.

Summary

The success of the Fort Sill recycling program as measured by the amount of materials diverted from disposal (nearly 700 tons (636.3 mt) per year - an estimated 5 percent of the waste generated) can be attributed to several factors:

1. The interest of an individual (DFAE) who has the authority to make facilities, personnel, and equipment available for such a program.

2. The participation of relatively large numbers of individuals accomplished by instituting the RAW Deal and through good publicity efforts.

3. The presence of interested markets, both local and distant.

4. The availability of military personnel to be assigned to the RCPA with minimal negative impact on other activities.

This combination of factors is not unique to Fort Sill. The first factor (an interested individual in a position of authority) is considered to be the most important in initiating a successful recycling program. With the presence of this factor the rest can virtually be assumed.

Two factors make the Fort Sill program distinctive: (1) the RAW Deal program, and (2) the lack of uniformity in the approaches used to separate and store recyclable materials at the various sources of generation. RAW Deal is the only known incentive program in the military with the purpose of encouraging recycling.

The key to the success of any recycling program is participation by the maximum number of individuals. The incentive award has been encouragement enough for unit commanders to motivate their troops to obtain recyclable materials. This has further spurred the interest of the material generators and has provided a large, motivated collection force.

While the operations of the RCPA and RAW Deal are well-documented and well-managed, the recovery activities at the sources of the recyclable materials are flexible, and depend on the individuals involved and the specific physical situation. This lack of uniformity has both positive and negative aspects.

To encourage people to participate, the methods used should be adapted to the specific work place and the facilities available. However, in the numerous office-type settings at Fort Sill, a relatively uniform approach using desk-top containers would likely increase participation. Coupled with this should be an educational program pointing out what kinds of paper to separate, what happens to the paper, and the results of the program. Such a program should markedly increase

participation. Coupled with this should be an educational program pointing out what kinds of paper to separate, what happens to the paper, and the results of the program. Such a program should markedly increase participation and the resulting recovery of office paper. Through this educational program, a better knowledge of the number of buildings and people involved in the program will be available. Likewise, buildings with low participation rates can be identified, and stepped-up publicity efforts used to increase interest in the program.

5 CONCLUSIONS

In order to completely assess the economics of paper recycling, the cost of collection and disposal of waste must be compared with the cost of collection and recycling. It is logical to assume that when recyclable material is collected, the cost of refuse collection and disposal should decrease. The amount of this assumed decrease is usually less than expected because when recycling is practiced, collection frequency is usually maintained. The real savings occur at the landfilling operation where savings are realized for labor, equipment, and land requirements. The total economic savings of recycling was determined by assuming reasonable collection and disposal savings based on reported disposal and savings costs at Fort Meade during FY76.

The Source Separation for Materials Recovery Guidelines field implementation at Fort Meade, MD, indicated the following:

High-Grade Paper

An economic survey of the installation indicated that it is only marginally feasible to recycle high-grade paper. The larger office buildings had the greatest economic feasibility, with 11 tons (10 mt) of waste generated per month at a total value of $677. This amount reflects a landfill disposal savings of $149. The total cost for collecting and storing this material was calculated to be $1167 per month, an amount greater than the revenues derived.

Newsprint

Approximately 13 tons (11.8 mt) of newsprint are delivered to Fort Meade each week. Calculations indicate that it is uneconomical to recycle newsprint. The least costly method of recycling newsprint is by mounting a rack on the refuse collection vehicle and collecting the refuse and newsprint separately. The total newspaper expected to be collected using this approach is 26 tons (23.6 mt) per month at a total value of $663. This amount reflects a landfill disposal savings of $351. The total cost for collection and storage is $1149, therefore giving a net loss of $486 per month.

Cardboard

Calculations indicate that it is economically sound to recycle cardboard by placing balers in the main post exchange, main commissary, and commissary annex. Approximately 124 tons (121.8 mt) per month are generated at a value of $2976. This material is diverted from the landfill at a savings of $1681. Thus, the total revenue and diverted disposal savings are $4657 per month. The total collection and processing cost is $2169 per month, with a net savings of $2488 per month.

When it became apparent that the Guidelines would not be fully implemented at Fort Meade due to unfavorable economics, the apparently successful and comprehensive voluntary recycling program at Fort Lewis, WA, and Fort Sill, OK, were evaluated. Neither the Fort Lewis nor Fort Sill voluntary recycling programs were subjected to the stringent economic analysis conducted at Fort Meade, because it was obvious to the evaluation team that the recycling programs at Forts Sill and Lewis were very labor-intensive. In a voluntary program, labor is not accounted for. Instead, the economic analyses conducted by each installation are reported and summarized.

Fort Lewis -- Volunteer Resource Recovery Program Economic Summary

For the following discussion, the costs of recycling have been minimized, with only DFAE maintenance costs, DPDO marketing costs, and high-grade paper container costs listed. Most of the costs associated with the recycling program are not charged to it. In additon to labor, other notable cost omissions are utilities, building and storage, haulage vehicles, and fixed equipment. Gross income for FY77 was reported at $33,511 with expenditures of $23,321, leaving an apparent profit of $10,190.

Fort Sill Economic Summary

The cost of recycling includes salaries of civilian employees assigned to recycling, maintenance of fixed equipment, and rental costs of mobile equipment. Items not charged as costs to the recycling program include utilities, maintenance on building, and additional charges by the refuse hauler for transporting material to the recycling center. Proceeds from recycling between 1 October 1977 and 31 March 1978 are reported at $24,760, with expenditures of $11,020, leaving an apparent profit of $13,740.

Fort Sill and Fort Lewis Summary

From the standpoint of participation and cooperation, the recycling programs at Fort Sill and Fort Lewis are highly successful because these two installations have conducted excellent public relations campaigns. Fort Lewis can attribute much of its success to support at the DFAE level, to Post Regulation 420-25, and to the Fort Lewis Environmental Quality Committee. Fort Sill's success is the direct result of the personal and innovative efforts of the DFAE and the Environmental Division Chief, who initiated the RAW (recycle and win) Deal program, which promotes competition between units and activities to recycle waste material. The Fort Sill Circular 420-47 also supports the program by putting evaluation of the recycling program under the control of the Inspector General.

The two key items found in these two voluntary recycling programs which are considered essential for successful implementation of any recycling program are: (1) interest in and responsibility for the recycling program at a meaningful level (DFAE or above), and (2) an innovative incentive program to develop and maintain public interest.

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