

collecting most residential refuse while private haulers collect from commercial and industrial firms and residences not served by public agencies. Experience demonstrates that satisfactory collection can be provided and managed at the county, municipal, or local level. Regional management of collection is not needed.

Disposal, although representing only a small part of the cost of refuse service, is more critical. Lack of adequate facilities and space for disposal are problems facing nearly every jurisdiction in this region. In the urban core, disposal space is a pressing need.

Arlington County has no space that can be used for landfill and the City of Alexandria and the District of Columbia are rapidly approaching depletion of landfill space. Natural conditions are generally unfavorable for landfill in Montgomery County. Because of the lack of landfill space, these four jurisdictions have adopted incineration to reduce the volume of solid wastes prior to final disposal. In addition, Alexandria and the District of Columbia burn, on open dumps, large quantities of combustible wastes which cannot be processed in existing incinerator plants.

Existing incineration facilities in Montgomery County, Arlington County, and Alexandria have adequate capacity for present quantities of ordinary incinerable refuse, but will need to be expanded if they are to process the bulky combustible wastes now being landfilled and burned on open dumps.

The District of Columbia needs to double its incineration capacity to handle combustible wastes. In the two to three years that will be required to plan and construct new incineration facilities, the District must either continue to burn combustible wastes on the Kenilworth Dump or must sanitary landfill these wastes outside the District.

Most of the existing incinerator plants in the Washington metropolitan region are not equipped with high-efficiency air pollution control devices. Equipment is available to clean incinerator stack gases to meet air pollution regulations. It is not inexpensive. Presumably, such equipment will have to be added to enable these plants to meet more stringent air pollution regulations expected in the future.

The other jurisdictions in the study area, Prince Georges, Charles, Fairfax, and Prince William Counties, contain land suitable for sanitary landfill. If these four counties will obtain sites now, they can utilize economical sanitary landfill disposal for many years.

Fairfax County operates a landfill which disposes of most of the refuse generated in the county. In Prince Georges County, the Washington Suburban Sanitary Commission's Anacostia sanitary landfill and a number of small municipal and private landfills meet present disposal needs. In both of these counties, however, the space dedicated to sanitary landfill is adequate for overall needs for only a year or two. The Public Works Department of Prince Georges County has developed a long-range County refuse program which, if implemented, will provide a satisfactory solution for disposal needs for many years.

Refuse Quantities

Population of the Washington metropolitan region was estimated at about 2.5 million in 1965. It is expected to increase to 3.8 million in 1980 and to 5.4 million by the year 2000.

Per capita production of refuse for disposal at incinerator plants, landfills, and burning dumps in 1965 was estimated as shown in Table I. Excavated and dredged materials are not included.

A considerably higher per capita production of refuse is indicated for the District of Columbia than for outside areas. This is due primarily to the higher proportion of governmental and business activity and the remodeling and urban renewal work in the District. The relatively low production of refuse in the suburbs reflects the general lack of industry in these areas.

Refuse production for the entire region in 1965 was estimated at 1.3 million tons of incinerables and 0.5 million tons of bulky nonincinerables, for a total of 1.8 million tons (Table I). Here again, excavated and dredged materials are not included.

TABLE I
PER CAPITA REFUSE PRODUCTION

Type of refuse	1965 Refuse Production pounds / capita / calendar day	
	District of Columbia	Outside District
Incinerable	3.60	2.50
Bulky Nonincinerable		
Combustible	0.50	0.30
Noncombustible	1.50	0.45
Total	5.60	3.25

TABLE II
ANNUAL REFUSE QUANTITIES IN TONS

Jurisdiction	1965		1980		2000	
	Incinerable	Bulky non-incinerable	Incinerable	Bulky non-incinerable	Incinerable	Bulky non-incinerable
District of Columbia	535,500	297,000	757,900	421,000	1,079,900	600,000
Maryland						
Charles County	17,100	5,100	36,800	11,000	97,000	29,100
Montgomery County	193,300	58,000	404,300	121,300	772,000	231,600
Prince Georges County	231,900	69,600	492,300	147,700	927,700	278,300
Virginia						
Alexandria, City	52,300	15,700	107,800	32,300	173,400	52,000
Arlington County	78,700	23,600	127,900	38,400	196,400	58,900
Fairfax, City	8,400	2,500	21,400	6,400	34,900	10,500
Fairfax County	146,300	43,900	364,800	109,400	789,200	236,800
Falls Church, City	5,100	1,500	7,700	2,300	11,600	3,500
Loudoun County	13,600	4,100	47,600	14,300	135,700	40,700
Prince William County	37,000	11,100	119,000	35,700	310,200	93,000
Total	1,319,770	532,100	2,487,500	939,800	4,528,000	1,634,400
Combined total	1,851,300		3,427,300		6,162,400	

Table II shows projected annual refuse quantities by jurisdictions in 1980 and 2000 A.D. It is significant that total annual refuse is expected to almost double by 1980 and to almost double again by 2000.

Alternative Disposal Methods

A national effort is being made to develop new and improved methods of refuse disposal. It is entirely possible that better methods than those currently employed will result.

At present, however, sanitary landfill and incineration with landfill of residue and noncombustible wastes are the principal refuse disposal methods available to the Washington metropolitan region. With proper sites, facilities, and operation, either method of disposal will be satisfactory.

Sanitary landfill normally costs \$0.70 to \$2.00 per ton of refuse, while incineration costs are usually in the range of \$4.00 to \$6.00 per ton. Because of its lower cost, sanitary landfill should be used where suitable sites are available within economical haul distance.

In general, conditions are suitable for sanitary landfill only in portions of the southern half of the region, principally in Prince Georges County, Charles County, and southern Fairfax and Prince William Counties. Potential sanitary landfill sites of sufficient capacity to dispose of a major portion of the raw refuse from the study area are remote from the urban core and outside the limits of the jurisdictions producing most of the refuse. Such sites may be difficult to acquire, and their use will result in high hauling costs.

Incineration of refuse to reduce the volume for final disposal by landfill is the most practical means for disposing of combustible wastes generated in jurisdictions lacking suitable sites for sanitary landfill. These include the District of Columbia, Montgomery County, Alexandria, Arlington County, and Loudoun County.

Disposal of bulky nonincinerable wastes, a difficult problem in jurisdictions lacking landfill space, can be facilitated by shredding. Shredded material can be processed in conventional incinerators and salvable ferrous metals can be economically separated magnetically.

Land Requirements for Disposal

Landfill space is necessary for any refuse disposal method because all methods leave a residue which can be disposed of only by dumping on the land or in water. Landfill space requirements can be reduced materially

by incinerating combustible wastes, by shredding bulky wastes, by salvaging and reusing materials where feasible, and by compacting wastes to the minimum practical volume.

Projected maximum and minimum landfill space requirements, by jurisdictions, are shown in Table III. Maximum requirements shown are for sanitary landfill of refuse without processing for volume reduction. Minimum space requirements are premised on maximum volume reduction by incineration or other processing methods prior to landfilling. The tabulation indicates that sanitary landfilling of all refuse would require about 3.5 times as much space as would be needed if wastes were processed for volume

TABLE III
LANDFILL SPACE REQUIREMENTS

Jurisdiction	Cumulative landfill space requirements in acre-feet			
	Minimum		Maximum	
	1980	2000	1980	2000
District of Columbia	5,155	16,026	16,784	52,764
Maryland				
Charles County	158	709	584	2,630
Montgomery County	1,771	6,916	6,575	25,688
Prince Georges County	2,167	8,355	8,044	31,032
Virginia				
Alexandria	492	1,754	1,827	6,510
Arlington County	627	2,016	2,327	7,488
Fairfax County	1,659	6,992	6,162	25,972
Loudoun County	175	954	653	3,541
Prince William County	446	2,277	1,658	8,455
Total volume	12,650	45,999	44,614	164,080
Land area required for average fill depth of 20 feet — square miles	1.0	3.6	3.5	12.8

reduction. In addition to requiring less disposal space, the residue of incineration and other reduction processes will make a more stable and useful landfill than raw refuse. Many sites that are not suitable for disposal of raw refuse can be used for incinerator residue and other relatively inert wastes.

Inventory Of Potential Disposal Sites

Land for landfills and incinerator plants is the greatest present and future

refuse disposal need of the Washington metropolitan region. The region does not have the natural conditions which make sanitary landfill an ideal refuse disposal method for some large urban areas. For example, it does not have the expanse of desert which offers economical and pollution-free landfill sites for cities such as El Paso, Texas. Neither does it have the deep, dry gravel pits and dry mountainous canyons within the urban area and within the limits of the jurisdiction producing the refuse which provide excellent landfill sites in Southern California.

Geological and hydrological conditions in the northern half of the region are generally unfavorable for sanitary landfill. Soil is shallow; springs outcrop in most valleys and ravines; and much of the area is within watersheds of public water supplies.

Conditions are more favorable for sanitary landfill in the coastal plains region comprising the southern half of the area. Here, soils are deeper; less of the area is in watersheds of public water supplies; and there are extensive marshlands which might be reclaimed by sanitary landfill. The southern area contains sufficient suitable land to permit sanitary landfilling of all refuse from Prince Georges, Charles, Fairfax, and Prince William Counties for many years.

However, sanitary landfill sites could be difficult to acquire. Many of the sites are planned for other uses and much of the land is expensive. Gravel excavations are shallow and can be reclaimed for development. Underwater excavations are not suitable for sanitary landfill. Most marsh areas are planned and reserved for conservation and park use. Much of the undeveloped land in Virginia is in watersheds of public water supplies where sanitary landfills could pose a threat of water pollution. Much of the land suitable for sanitary landfill is in outlying and sparsely populated areas which produce little refuse.

Prince Georges County contains sufficient potential sanitary landfill sites to meet its needs to the year 2000. But, space for long-term sanitary landfilling of refuse from other jurisdictions, such as the District of Columbia, is not available unless filling of marshland currently planned for conservation and park use can be permitted.

The potential sanitary landfill sites in Fairfax County would be adequate for the needs of the county and the cities of Falls Church and Fairfax until about 1985. Fairfax County, however, could not provide long-term sanitary landfill sites for other jurisdictions such as Arlington County and the District of Columbia. It does contain several potential inert fill sites located on

Federal and other lands which could accommodate incinerator residue and inert wastes from these jurisdictions for many years.

Isolated areas in the southern extremity of the Washington metropolitan region could accommodate all refuse from the region until the year 2000. However, transportation cost would be high and legislative and legal action would probably be necessary to establish regional disposal facilities there.

Consideration of increasing refuse quantities and the limited amount of landfill space in the Washington metropolitan region leads to the conclusion that more incinerator plants will be needed in the future. Good incinerator plant sites are limited now and will almost certainly become increasingly difficult to find as the region develops. Therefore, those jurisdictions which will need incinerator plants in the future should acquire plant sites now while they are still available.

Transportation of Solid Wastes

Hauling refuse from the collection route to the point of disposal is a significant factor in the cost of refuse service and must be considered in evaluating disposal methods and sites. Truck haul costs may range from \$0.10 to \$0.50 per ton-mile (based on one-way distance and including the cost of the return trip).

Best opportunities for reducing haul costs are: minimizing haul distance, minimizing labor involved in hauling, and increasing payload. Transfer to, and haul in, large capacity vehicles may be feasible under certain conditions. Use of multiple disposal sites should also be considered as a means for reducing haul costs.

The cost of hauling incinerator residue to distant disposal sites can be minimized by the use of large, self-dumping, tractor-semitrailer units. All jurisdictions operating incinerator plants should give consideration to economies afforded by larger ash haul vehicles.

Barging will be a feasible method for transporting incinerator residue and nonincinerable wastes to landfill sites accessible from the Potomac River and a considerable distance downstream.

Haul by rail also may be feasible. Railroads presently are investigating the cost of providing this service.

Summary

The bulk of solid wastes operations can be managed at the local level by proper application of present techniques. The problem has been defined.

No magic solutions are in sight. Each jurisdiction must initiate solutions to as much of the problem as possible.

Some of the problems can be solved only by cooperation among major jurisdictions. Interjurisdictional cooperation or a regional authority will be needed to handle problems incapable of solution at lower levels. On the other hand, the solid wastes problem cannot be escaped by total abdication of local responsibility to a higher authority.

The time for local action is now.

AIR POLLUTION AND SOLID WASTE DISPOSAL PRACTICES

*John T. Middleton **

I AM PLEASED to have an opportunity to participate in this conference. I think we can all agree that, for the most part, current waste disposal practices in the Washington area are not only obsolete, but are an insult to our senses and a source of many problems affecting public health and welfare. The refuse produced in this area is being disposed of in ways that contribute to all of our environmental pollution problems, ways that represent a sheer waste of valuable resources, and that make our surroundings increasingly ugly and offensive.

Among the many problems associated with refuse disposal in the Washington area, air pollution is clearly the most obvious and the most serious. I know, as I am sure all of you do, that many diverse factors must be taken into consideration in developing a practical plan for disposal of solid waste in this or any other urban area. Effective control of air pollution is just one of those factors, but it is one which cannot be ignored. No solution to the refuse disposal problems of our modern society can be truly acceptable if it perpetuates those waste disposal practices which add unnecessarily to the burden of air pollution.

No doubt, most of you know that the Secretary of the Department of Health, Education, and Welfare, John W. Gardner, has called for Federal action to abate interstate air pollution in the Washington area. An abatement conference will be held later this year, probably within the next few months. We are currently in the final stages of a technical investigation of the sources and extent of the area's air pollution problem and of its impact on public health and welfare in both the District of Columbia and the suburbs. This investigation is providing, among other things, a full appraisal of the extent to which open burning and incineration of refuse are contributing to air pollution in the Washington area.

I believe that Secretary Gardner's reasons for initiating interstate air pollution abatement action in this area and the Surgeon General's reasons for calling this conference on solid waste management had one important thing in common. That one thing was an awareness that both air pollution

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and refuse disposal are basically regional problems, whose solution will, in very large measure, require coordinated regional action.

In the seven months that I have been in Washington, I have seen many indications that this need for regional action is recognized to some extent by local officials and citizens of the area; certainly, the activities of the Metropolitan Washington Council of Governments are evidence of some recognition that the various communities in the area cannot fully solve their air pollution and refuse disposal problems on a do-it-themselves basis.

For the most part, however, these facts do not seem to be widely enough appreciated to serve as a basis for constructive action. There seems to be a marked tendency to believe that all, or nearly all, of the area's air pollution, particularly air pollution arising from solid waste disposal, originates in the District of Columbia. This is a myth; it is a myth that must be dispelled, once and for all, if the people in the Washington area are to succeed in ridding themselves of the air pollution problems associated with refuse disposal.

Estimates based on preliminary data from our current technical investigation indicate that an overwhelming share — about 80 percent — of all the refuse produced in the Washington metropolitan area is currently burned. Only 20 percent is buried in landfills. This means that of the estimated 1.5 million tons of refuse disposed of each year in the area, approximately 1.2 million tons are burned. Municipal incinerators, including the four in the District of Columbia and those in Alexandria, Arlington, and Montgomery county burn 680,000 tons. Some 160,000 tons are burned in open dumps — most of it, of course, in the Kenilworth Dump, and smaller amounts in dumps located in Prince Georges County, in Maryland, and in Prince William County and Alexandria, in Virginia. All other incineration by commercial, industrial, and residential equipment scattered throughout the area, poorly equipped, if at all, for control of air pollution, accounts for 206,000 tons. Backyard trash burning accounts for 108,000 tons.

Open burning and incineration of refuse are sources of several important types of air pollutants, including carbon monoxide, hydrocarbons, and particulate matter. The most obvious, of course, is particulate matter — the brown and gray smoke that shrouds the area and reduces visibility, and the flying fragments of half-burned trash that accumulate on cars and window sills and blacken buildings and monuments. But the obvious effects are not the only effects. Not all of this airborne filth ends up on cars and buildings; some of it inevitably ends up in our lungs and other parts of

the human respiratory system, where it has been known to have irritating or toxic effects, or both.

In the Washington area, refuse burning accounts for an estimated 22 percent of all the particulate matter released into the air from all sources. Among the various categories of air pollution sources in the area, only power plants account for a greater share of particulate pollution. The actual amount of particulate matter released into the air from refuse disposal operations of all kinds is estimated to be about 8,600 tons per year. About two-thirds of the total comes from sources in the District of Columbia, with the Kenilworth Dump contributing about half of that, while the other one-third comes from sources in suburban Maryland and Virginia.

The most obvious conclusion we can draw from these figures is, of course, that efforts to reduce air pollution from refuse disposal operations in the Washington area can most profitably be concentrated in the District of Columbia. This is indeed a valid conclusion. There can be no doubt that closing of the archaic Kenilworth Dump is an essential first step. This action would, in itself, keep more pollution out of the air than would any other single step we can take. But it is important to recognize that no such step will be truly fruitful, in the long run, if action is not also taken to develop a coordinated regional plan for dealing with the solid waste problem.

I believe that a brief look into the future will indicate what I mean. As I said earlier, our estimate is that about 1.5 million tons of refuse are currently discarded in a year's time in the Washington metropolitan area. But this total will increase as the area's population grows and as consumption of goods and services increases. Furthermore, since most of the area's growth is taking place in the suburbs, it is in Maryland and Virginia that refuse disposal problems will inevitably grow at the fastest rate. In the long run, then, the view that refuse disposal is strictly a local problem will have its most serious effects in our suburban communities. This one consideration is, in itself, a compelling argument in favor of regional cooperation in dealing with this problem.

Exactly what form a plan for regional action might take is a basic question which I hope this conference will consider very carefully. No matter what you decide, however, there are several fundamental considerations that cannot be ignored if you are to break the sinister link between refuse disposal and air pollution.

The best solution is, of course, to stop all burning of refuse. This is

no easy matter in an area such as this one, where 80 percent of all refuse is disposed of by burning. I am certainly not suggesting that you place an immediate ban on both open burning and incineration. But what I am suggesting is that you explore all potentially practical ways of dealing with the refuse problem without lighting any fires.

I, for one, cannot believe that this area is employing sanitary landfilling to the fullest extent possible. I know that many people who would otherwise have no objection to landfilling suddenly find it objectionable if a landfill site is to be located in their own neighborhood. Their attitude is easily understandable in an area where so little landfilling is done, where few people have had an opportunity to see that landfilling need not be a public nuisance or health hazard. To those people who are concerned about these problems, I can only say that properly operated sanitary landfills make better neighbors than even the best incinerators.

Though the Washington area, like any other in this eastern megalopolis, must eventually run out of suitable space for landfilling, this approach will at least give you enough time to experiment with other approaches. I assure you that there are others, including some which are already in use and some which are still experimental; you will undoubtedly hear about many of them before this conference is over. I urge you to think at least as much about the real possibilities inherent in each one as you do about the seeming limitations. In this era of technological miracles, the ways of collecting, transporting, and disposing of refuse can hardly be limited by our ability to design and build the necessary hardware; the only real limitation is the extent to which all of us are willing to accept, or at least examine, new ideas.

We must also be ready and willing to give up some old and cherished notions. One that may well have to go is the idea that every large building should have its own incinerator. In particular, the installation of single-chamber incinerators in new buildings is an obsolete practice that should no longer be perpetuated. Though such incinerators may be relatively small factors in the area's total air pollution problem, each one is a major source of pollution in its own neighborhood. And where many buildings are crowded together, even in areas far removed from the Kenilworth Dump, the fallout from apartment-house incinerators must make many people wonder whether it is so desirable, after all, to live in the city. It is likely that until we recognize the true nature and extent of the growing waste disposal problem and vigorously pursue more adequate solutions, some waste will have to be disposed of by burning. If we must burn waste, it would be

far better to burn it in modern and well-operated municipal incinerators. I will concede that there are not very many of those, either in this area or elsewhere in the country. But in the past few years, largely because of the stimulus provided by the Solid Waste Disposal Act, incinerator technology has begun moving forward; moreover, large municipal incinerators can be equipped with highly efficient secondary collectors such as precipitators or scrubbers for the control of air pollution. No municipal incinerator anywhere in the country is currently equipped with such devices; however, under a grant from the Public Health Service, the District of Columbia is developing plans for a new incinerator that will incorporate the best available pollution control techniques, and New York City recently announced plans to add such equipment to its municipal incinerators.

In the future, if additional community incinerators prove necessary to meet the Washington area's needs, regional cooperation will be essential. In particular, it will be only through regional cooperation that full advantage can be taken of opportunities to locate such facilities in outlying areas, where conditions for diffusion of air pollutants are, as a rule, more favorable than in congested urban areas, and where modern, well-operated incinerators need not be a problem. Since increasing amounts of refuse will be produced in the suburbs, hauling need not be burdensome, and a compelling desire coupled with ingenuity will assure the development of new techniques which will reduce the expense.

There are no quick and cheap ways to deal with the problem you have come here to discuss. I believe that there is ample evidence in the Washington area to demonstrate that short-cut ways of disposing of refuse are the most expensive, in the long run. I have also seen a great deal of evidence which suggests that the people of the Washington area want cleaner air. That goal can be reached only through conscious planning on a regional scale. If a plan existed, we would not be here today. If this group cannot take at least the first steps toward the development of a rational and practical plan, then none of us should be surprised if the people of this area eventually begin to insist upon drastic measures. The more than two million people who live in this area ought to be able to discard their trash without having it returned to them through the air.

SOLID WASTE HANDLING BY FEDERAL INSTALLATIONS

*Fred W. Binnewies **

IN HIS NATURAL BEAUTY message on February 8, 1965, President Johnson said, "The beauty of our land is a natural resource. Its preservation is linked to the inner prosperity of the human spirit . . . Our land will be attractive tomorrow only if we organize for action and rebuild and reclaim the beauty we inherited." And Secretary of the Interior Stewart Udall commented in much the same vein, "Yesterday's conservation battles were for superlative scenery, for wilderness, for wildlife. Today's conservation battles are for beautiful cities, for clean water and air, for tasteful architecture, for the preservation of open space." We can hardly win the battle for beautiful cities and clean water and air unless the problem of waste disposal is solved. As the President said, we must organize for action and rebuild and reclaim the beauty we inherited.

Waste disposal is certainly not a new problem but it has been with us in increasing importance for many centuries. The old cliff dwellers of the Southwest merely threw their broken pots and trash, including a few bodies now and then, out the front door. Often, enough fill accumulated so they could build on top of it as much as we do now. This practice, I must say, has been much to the delight of present day archeologists who depend on trash dumps to give them clues to the culture and ways of life of the people of those times. Think what a lot of fun archeologists of the future will have delving in the dumps we are now creating. What kind of an impression will they have of our civilization?

Our problem today is not to make it so easy for those future archeologists but to devise better, more efficient, ways of getting rid of waste materials. The challenge is nowhere greater than here, in the nation's capital, the home of more than two million people, visited by an estimated 15 million more each year. Almost all of the visitors use the National Capital Parks, administered by the National Park Service of the Department of the Interior, in one way or another, and many leave a calling card in the way of trash. A great deal of our effort is spent just cleaning up after people. Over 300,000 cans of trash were picked up and disposed of last year.

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Most of the waste collected in the National Capital Parks is disposed of by burning in incinerators or dumps operated by the District of Columbia or other municipalities. For example, we use the incinerator at Mt. Olivet and West Virginia Avenue, N.E., dump unburnable material at Kenilworth, and also use the incinerators at Georgetown and Alexandria. Tree trimmings, branches, and trunks that cannot be disposed of by chipping are burned, in small quantities, 2.5 tons per day, at the District of Columbia plant nursery.

A disposal problem for which there is no good solution at present is what to do with trees affected by Dutch Elm disease. Many of the American Elms in the District of Columbia are infected with the disease and unless the tree is destroyed soon after the elm disease is identified other trees can be infected. Burning is the surest method of disposing of infected trees. Incineration has been tried but it does not work well due to the length of time it takes to consume large tree trunks or stumps. An incinerator can be tied up for days while other trash continues to accumulate. Considerable research is being conducted in an effort to find an effective control for the disease but until it is successful we must continue with open pit burning.

The disposal of waste needs to be a cooperative effort but this is not always the case. Montgomery County, Maryland, has passed an ordinance prohibiting the dumping of trash originating on Federal property on any city or county dump. This affects portions of the C&O Canal National Monument since it would be less costly and more efficient if county facilities could be used. I understand from the newspapers that Prince Georges County has passed a similar ordinance prohibiting trash trucks from the District from operating in the county. This, of course, compounds the problem in this highly concentrated metropolitan area.

Waste disposal is a costly business at best and it is going to get more so as greater emphasis is given to clean air and water. The National Capital Parks spend about \$500,000 annually for sanitation activities and \$200,000 for Dutch Elm disease control and other tree work. The cost goes up each year despite the fact that the public is getting more litter conscious. We had a good example of this public awareness just the other day. The morning after the Fourth of July we found trash baskets overflowing, but the excess litter was piled around the baskets and not scattered over the landscape. This made our job much easier, and we really appreciated this kind of concern on the part of the general public. There are two things that would help immeasurably to reduce waste disposal problems — make paper so expensive we couldn't afford to throw it away, and develop a beer can that

would disintegrate soon after it was discarded. Neither of these are very practical, I'm afraid.

Some good can come from solid waste disposal. For example incinerator ash is being deposited as fill in Kingman Lake and when completed it will be used for a golf course. The Kenilworth Dump is gradually being covered with dirt and it will be turned into an attractive park and outdoor recreation area when completed. Dyke Marsh is being filled with dirt and it will be developed for recreation. The problem, of course, is what is to be done with the trash when these places have reached their limit. There are not many places where landfill can be used to an advantage and they are becoming more scarce each year. With the scarcity of land available for parks and recreation areas, however, cities, counties and states should not overlook the potential of developing recreation facilities on reclaimed dump areas. In fact this can be an incentive to help overcome local objections in order to establish sanitary landfill sites.

Vast improvement can be made in waste disposal if we will only do it. More efficient incinerators can take the place of open burning, scrap metals can be reclaimed, and some method can be developed to pulverize and reuse brick and concrete. I heard recently of a company in Florida that is processing garbage into compost. Proposals have been made to use the heat from incinerators for generating electricity or other beneficial use. This can cut down the expense of waste disposal. I feel sure modern technology can develop better methods for waste disposal if we will give the incentive. Conferences such as this can provide that incentive.

SOLID WASTE HANDLING BY FEDERAL INSTALLATIONS

*William H. Eastman **

IT IS INDEED AN HONOR to participate in this conference which deals with the enormous problems in the disposal of waste materials which we in the Washington, D.C. area, generate during our daily activities.

Let me take a minute to give you a word picture of the mission of the General Services Administration (GSA). From our GSA regional office in Washington, the largest of ten throughout the nation, we service virtually every United States Government agency in the states of Maryland, Virginia, West Virginia, and the District of Columbia, with an organization that employs approximately 12,000 people. We served as landlord, purchasing agent, and superintendent, with sundry other management functions. We have some measure of management responsibility for almost 1,300 government-owned buildings and leased facilities, representing approximately 55 million square-feet of space.

Ladies and gentlemen: The people who occupy these 55 million square feet generate tons of waste material daily. This waste manifests itself in several forms: such as, waste paper, trash, debris, classified paper and films, sewage, and other singular disposal items. Each of these items must be handled in a special manner.

The practice and procedures used in the disposal of waste paper, trash, and debris must be closely coordinated. For example, waste paper mixed with trash increases the quantity of trash which we must pay to have removed from our buildings and decreases the quantity of waste paper which can be sold.

Let me take a few minutes to define some types of waste generated in our buildings and how we in GSA handle the disposal of these materials.

Waste paper, scrap materials, and refuse are classified as follows:

Saleable paper. When we talk about this type of waste we refer to all kinds of paper such as the waste paper deposited in the waste baskets located at each of our desks — high-grade type paper generated in printing plants — tabulating cards, books and corrugated containers. Through committee

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studies, initiation of disposal practices, and, most important, education of our employees, we were successful in recovering, in FY 1966, approximately \$350,000 from the sale of waste paper alone. As a point of interest, within the past few years waste paper tonnage has jumped from about 50 tons per day to about 90 tons per day (in the Washington area). The collection and disposal of this type of waste paper is handled in several different ways. In some of our buildings, many tons of the paper are baled by GSA employees, and these bales are picked up by contractors at regular established times and dates. In other locations, saleable waste paper is placed in either disposable paper bags or in reusable canvas bags and then picked up by the paper company which has the waste paper collection contract.

Nonsaleable paper. We have an accumulation which consists of paper cups, cartons, carbon paper, and the like. Since we must pay to have the nonsaleable paper removed from our buildings, our buildings supervisors conduct frequent inspections to ensure that the established handling procedures are being followed in order to minimize our trash problem.

Trash. This includes all burnable refuse such as (but not limited to) scrap, lumber, crates, boxes, and unsaleable paper. We must pay a flat monthly rate for the removal of trash. The removal of trash and debris is let to the lowest contract bidder for a period of one year.

Debris. When we speak of debris, we are talking about nonburnable trash such as plaster, wallboard, brick, stone, tile, and so forth. Debris from our buildings is removed by commercial contractors. We pay by the cubic yard for the removal of debris.

The scrap metal generated in our buildings is collected, classified, and stored as ferrous and nonferrous metal. Both are disposed of by selling to the highest bidder. Several years ago disposal of burned out fluorescent light tubes was a very costly item, and a dangerous operation because these tubes were thrown on the debris pile and disposed of by hauling to the dump. We now have installed in several of our large buildings, a machine which crushes the tubes, thereby permitting ease in handling the disposal of these items. During the course of our monthly operations, we generate hundreds of 55-gallon drums, these drums are collected at a main collection point, as are old tires, tubes, and storage batteries and these items are also sold by our property disposal people. By educating our employees and by initiating sound disposal procedures and practices, we were successful in recovering approximately \$700,000 last year from the sales of all types of waste, as compared with about \$327,000 in fiscal year 1964.

During the planning stages for the construction of new buildings, we in Public Buildings' Service review the proposed building plans and make recommendations for the installation of modern machinery such as paper pulpers, paper macerators and other types of waste disposal units to alleviate or assist in the disposal problems. Classified papers and film for example are disposed of by one of three different methods: incineration, wet-pulping, and dry disintegration or hammermills.

There are 20 incinerators in GSA region III buildings, all agency-operated. Two of them are equipped with afterburners and wet scrubbers for removing odors and fly ash. The remaining 18 are essentially natural draft installations without devices for fly ash control. Surveys have been made on these 18 units, and corrective measures, making them acceptable from an air pollution standpoint, have been determined. Two incinerators are designed for the destruction of animal wastes, 18 for the incineration of classified wastepaper with several of these 18 for the burning of classified film as well. The biggest problem encountered in the operation of these incinerators is the discharge of fly ash to the atmosphere. Wet pulping installations are used in some of our buildings for the destruction of classified wastepaper. The largest wet pulping plant operates eight hours per day, five days per week, and processes eight to ten tons of dry classified wastepaper per day. Equipment of this kind destroys paper effectively and does not create an air pollution problem. However, first costs are high, and there are problems associated with corrosion, maintenance and disposition of the baled wet pulp.

Paper disintegrators or hammermills effectively destroy classified waste paper by reducing it to a dry pulp with complete loss of identity. At the same time they destroy items like paper clips, staples, rubber bands, film, metal plates and glass slides. A hammermill installation requires a water spray to control dust and explosion hazards. One such plant is in operation three shifts a day, seven days per week and produces about 20 tons per day of completely disintegrated classified wastepaper in the form of baled dry pulp. This pulp is sold to a paper pulp processor for industrial reuse. The great bulk of Federal buildings administered by General Services Administration discharge their sanitary wastes to municipal sanitary sewers. This sewage is then conveyed to municipal sewage treatment plants for treatment, and does not constitute any further solid waste disposal problem.

The Virginia sewage disposal plant is an exception to this rule in that it is a self-contained plant, operated in its entirety by GSA region III. It is located about 500 feet southwest of the Potomac River boundary channel and one-half mile northwest of the Potomac River lagoon. This plant treats

the sewage from the Pentagon, Federal Building 2, Naval Facilities engineering command building and the South Post residence halls of Fort Myer. An average of 1.1 million gallons per day (MGD) of domestic wastes receives secondary treatment in the Virginia (Pentagon) sewage treatment plant. Peak flow rates of 2 MGD occur, and are adequately handled since the plant was designed for a flow rate of 3.2 MGD. Chlorine is added to the effluent as it leaves the outfall pipe to the boundary channel which leads into the Potomac River. The digested sludge after being dewatered in the vacuum filter and air dried is used by the National Park Service as fertilizer and soil conditioner in the numerous parks in the area.

Many 'one time' disposal problems arise that require special attention. For example, the Public Health Service, GSA emergency supply depot, at Cheetam Annex, Williamsburg, Virginia, is responsible for the storage or pre-position hospital units. These pre-position hospital units are completely equipped field units which can be sent to selected emergency sites throughout the country in times of need. PHS professional advisory committees continuously make quality control checks on supplies and equipment which are a part of these units and recommend the disposal of items which have deteriorated and have been determined to be professionally unacceptable for use. Disposal procedures guidelines for the disposition and destruction of deteriorated items in the medical stockpile depots are issued by the Stockpile Management Branch, Division of Health Mobilization. On May 1, 1967, a memorandum was sent from the PHS stockpile management branch to the PHS/GSA emergency medical supply depot at Cheetam requesting the disposal of intravenous injection sets. The Cheetam depot now has the job of disposing of some 2.5 million injection sets. The guidelines as set by the stockpile management branch state that all consumable items will be completely destroyed by burning, crushing, and then burying, unless contents are entirely consumed by incinerations. The GSA personnel at Cheetam decided to dispose of the condemned injection sets by burning. However, the attempts to dispose of these units by burning proved unsuccessful because of the large amount of air pollutants which were created and which threatened surrounding countryside and the city of Williamsburg. It was then decided that the most feasible and safe method to use for disposal of these units would be crushing and burying. A potential health hazard was thus aborted by careful implementation of approved disposal procedures.

Another 'one-time' problem to which GSA is now seeking a solution has occurred at the GSA/PMDS depot at Curtis Bay, Maryland, where large quantities of thorium nitrate, a rare low-level radioactive-chemical element,

are stored. These chemicals at the depot are both foreign and domestic in origin. The domestic material was stored in fibre drums with polyethylene liners, while the foreign material was stored in metal 55-gallon drums with one or more liners. Both types of materials in their drums are then stocked on pallets and placed in storage sheds at the depot. Over a period of time it was discovered that the drums and liners in which the thorium nitrate was stored had somewhat deteriorated and several of the drums were leaking. The decision was made to repack the chemicals, and this was accomplished by depot personnel using approved safety procedures. After the repacking operations had transpired, tests were made to check for any radiation contamination which may have resulted from the leakage and the repacking operations. Contamination of a low-level intensity was found on the pallets and also on the flooring where the drums had been located. The disposal of the contaminated flooring and pallets has been a unique problem. Fear of polluting the air with radioactive material prohibits burning as a solution. At present the contaminated material, both pallets and flooring, which have been removed from its original location have been secured pending a solution to the disposal problem.

Yes, GSA is indeed involved in problems of solid waste disposal. Our realm of responsibility extends from the relatively insignificant task of emptying a trash can to the monumental aspects of preventing a potential health hazard to large communities. We at GSA are extremely interested in contributing to the development of modern disposal practices in each and every one of the disposal activities in which we are involved.