ABSTRACT

Master planning for community incinerator design to meet a community's current refuse disposal needs involves consideration of many more factors than just the design of the facility itself. Basically, these considerations fall into two major classifications — the social and the economic. The latter group has long been the deciding factor, but with increasing air and water pollution, increasing numbers of man-made materials that do not decompose, and a mounting burden of refuse in proportion to an ever-growing population, more attention must be given to the legacy we are leaving to coming generations.

Sites should be selected when possible, in relation to current population densities, anticipated population expansion patterns, projected land use in the area under consideration, the health and comfort of those presently living in areas adjacent to the plant, and the projected total incineration needs of the community. Since the average life of a plant is about 20 years, thought must be given to future use of the site, when it may be no longer economically feasible to operate because of obsolescence, exhaustion of surrounding areas requiring landfill, or a shift in population density.

INTRODUCTION

Master planning for community incinerator design involves consideration of many more factors than just the design of the facility itself to meet a community's current refuse disposal needs. Traditionally, incinerators were the community's step-children, tucked away out of sight whenever possible, as far away from human habitation as an available location could be found. Once a site was selected and agreed upon, little if any attempt was made to consider anything but how to accomplish the function of the installation — burning of refuse — at the lowest possible cost to the community.

Today we no longer have available the land space to permit isolation of structures, nor out of the way places where they might be hidden away. Even if we did, the costs of transporting refuse to isolated areas would be out of line.

Population forecasts indicate a U.S. population of close to 340 million in the year 2,000 [1]. Anticipated increases in per capita refuse production are based on the experience of the past ten years during which it rose from 4 lb per day to nearly 5 lb per day [2]. Consequently the need to approach the problems of municipal refuse disposal in a more precise and well-defined manner than heretofore is apparent.

In recent years also, growing concern with increasing air and water pollution have focused attention on the by-products of the incineration process and brought pressing demands for development of new methods to control them. Such items as the larger numbers of synthetic materials, many of which will not decompose, and some of which produce poisonous fumes when burned, must be disposed of safely and economically. Very bulky materials which require too much time to burn thoroughly
are normally buried, as are non-combustible materials, and the approximately 10 percent residue volume remaining from the incineration process. But areas suitable for landfill will soon be at a premium. In some highly urbanized communities, this condition is no more than a few years away, and other means of disposing of these materials will have to be found.

All of these factors highlight the fact that along with economic considerations, perhaps the most important consideration in incinerator design is how to provide maximum efficiency with a minimum of undesirable side effects. We must give serious thought now to the legacy we are leaving for the generations who will follow, as well as to providing for the health, safety and welfare of the present population.

SITE SELECTION

Site selection for a municipal incinerator should be based on factors other than the mere availability of a piece of property or political expediency. Current population densities in the municipality and the trends these are likely to take as the population expands must be carefully studied in relation to the cost of setting up collection routes and the distances trucks will have to travel. Total incineration needs of the community, both present and projected, must be considered. In some cases, construction of two or more smaller plants in strategic locations could prove to be more efficient and economical in the long run than would a single installation designed to handle total need, although the latter might be less costly initially.

Present and anticipated use of the land in the neighborhood under consideration must be investigated carefully. Expansion of the community into the surrounding area could bring commercial development as well as housing. Construction of a large industrial plant in the vicinity could also bring a rapid influx of new residential housing and other facilities to serve the people working in the plant. Immediate community development might take place in another area so far removed from the incinerator plant as to make it uneconomical to truck refuse the distances involved.

Another consideration in relation to site selection is the availability of nearby areas requiring landfill. When these are exhausted, the costs of carrying residue and non-burnable farther afield soon becomes prohibitive.

PLANT SIZE AND CAPACITY

Determining the actual continuous burning capacity of a proposed plant is vital to its ability to satisfy community needs — both present and future. The usual method of applying a nominal rating based on theoretical capacity established by previous industry design criteria can be misleading and may provide a plant too small and inflexible for those needs. It has long been considered good design to plan for multiple units in the event of operational failure of one unit. While it obviously costs more to build two 150-ton plants than a single 300-ton plant, the benefit derived from having separate units far outweighs the cost, particularly when rating is based on a continuous burning operation. By borrowing from the power industry the concept of "firm power," that capacity remaining for operation when the largest of multiple units is off the line, the incinerator plant can be designed with an assured actual continuous burning capacity so that there will always be enough available capacity to prevent refuse accumulation.

For example, an incinerator installation comprised of a total of 750 tons capacity, split into three 250-ton units, would give an assured capacity of 500 tons. Incinerator operators describe such an installation as three 250-ton plants. Employing the firm power concept, it is a 750-ton plant with a firm capacity of 500 tons.

PLANT OBSOLESCENCE

The rate at which the plant may become obsolete is still another factor the designer must consider. Currently, the average life of a good plant is about twenty years. However, incineration is not an absolute science, the state of the art is constantly changing, and advancing technology conceivably may shorten this span in the years ahead. Much new equipment has comparatively short track records, so the question of whether to specify the newest development or stay with the older, proven methods is one for which there is no general answer. Each case must be studied and decided on its own merits.

FUTURE SITE CONVERSION

As an integral part of a master plan for a community incinerator plant, one must also include consideration of future conversion of plant and site for community or private use, once it ceases to fulfill its present function. Such future conversion is often largely dependent upon the character of the incinerator site and its long-range effects on the vicinity. Too often in the past the presence of an incinerator plant in an area tended to downgrade the neighborhood. This need not be the case. The
character of the incinerator building and its surroundings need not be unpleasant or unsightly. Good design of a pleasing, functional structure, proper maintenance and operation, and an adequately landscaped site can make a modern incinerator plant an asset to a neighborhood and to the entire community. Retention of as many existing desirable natural features as possible will allow much greater flexibility in planning for future use of both site and structures for such developments as a community recreation area, an industrial park, or the core area for future housing.

AESTHETICS

The quality of aesthetic design of the plant is a vital factor in community acceptance. Incinerator plants can be housed in attractive buildings with pleasing proportions, colorful or textured facades and surrounding landscaping.

The only element that need distinguish an incinerator plant is the chimney, and the height of the stack can be visually minimized. Any unsightly activities or areas such as unloading or storage pits can be screened from view by trees and shrubbery by placing them within buildings.

FIG. A AERIAL PHOTOGRAPH SHOWING EXISTING INCINERATOR SITE AND ADJACENT ACREAGE RECOMMENDED FOR ACQUISITION
by placing them in the lower areas of the natural configuration of the landscape, or, as we did in one case, by surrounding the plant with a berm, thereby creating a depression in which the plant was located.

Good design, both outside and inside the plant, can have the added advantage of creating the kind of environment that will attract more competent employees to the municipal incinerator. Currently, employment in an incinerator plant is not considered a desirable occupation, and more desirable competing fields get first choice of skilled or technically trained people. To attract those with adequate training to handle increasingly sophisticated equipment and operations, the entire concept of working in an incinerator needs upgrading in the public mind.

Separation of the burning floor from other parts of the plant, and the use of air conditioning in offices and wherever else possible (including the cab of the crane) alleviates problems of heat, odor and insects which cannot be avoided where refuse is present. Inclusion of showers and lockers for employees so that work clothes can be left at the plant is a great boon to those who must work in the refuse-handling areas. None of these features adds materially to the cost of a modern plant, but they can have a considerable effect on efficiency of operation. More modern plants burn better and operate better, and the improvement cannot entirely be credited to technological improvement in the incineration process.

Careful operation and maintenance of the plant and surrounding areas are, of course, requisites to continued aesthetic quality, but any additional costs incurred in these areas will be more than offset by the maintenance of land values not only of the site itself but in the vicinity.
ECONOMIC FACTORS

Future conversion of the site is a highly important economic factor, because presently it is one of the few possible offsets for the cost of a plant. In the interim period before conversion, the only other cost offsets are increased value of land used for landfill operations, and any possible use that can be made of the residue. The latter is largely unfeasible, particularly in metropolitan areas, because of the high labor costs involved in preliminary sorting of refuse to reclaim metals or other re-usable non-burnables. In a few instances, well-burned residue has been used for surfacing parking lots and such areas, but even if this practice were widespread, it could utilize only a small fraction of the residue available. Use of the incinerator plant as a possible power source is largely deemed unsatisfactory because of the highly variable quality of refuse as fuel. Also, the easy availability of high quality fuels in this country has limited consideration of the concept.

The lack of clarity in the economic picture presents a considerable challenge to the designer. For against uncertain, and, at best, comparatively small return in costs, he must weigh the costs of installing and maintaining equipment over the plant's period of useful life. He must decide how far to go in selecting automated equipment. Above all, he must give careful consideration not only to the initial costs of such sophisticated installations, but to the costs involved in the use of relatively untested equipment by personnel oftentimes untrained to the degree necessary to handle the complexity of the job they are called upon to do [3].

Some of the other economic factors to be considered have already been mentioned — the possible unknowns

FIG. C FIRST PHASE OF RECREATIONAL PARK DEVELOPMENT INCLUDING GAME AREAS, SKATING RINK, TENNIS, BASKETBALL AND HANDBALL COURTS AND BASEBALL FIELD
that may affect the character of the plant’s vicinity such as a sudden movement of industry into a heretofore sparsely settled residential area, or possible future shifts in population centers served by the plant. Each plant currently designed must be given sufficient flexibility to encompass not only the community’s existing needs and to take into consideration already existing facilities, but also the community’s future need for additional facilities.

A TYPICAL “MASTER PLAN” FOR AN INCINERATOR SITE

Included with this paper are photographs showing a typical phase development over a twenty-to thirty-year period. These illustrate the various development and reclamation procedures which can be utilized in a development of this type and suggest the ultimate use of the site as a recreation area. There are, of course, other possible uses such as development into an industrial complex.

On the site illustrated, we recommended construction of a plant with a nominal rating of 300 tons a day to replace an existing 30-year-old, 90-ton plant. Our plan included the following for immediate or future action:

1) Acquisition of additional acreage adjacent to the existing site for future residue burial. (Fig. A)

2) Upon completion of incinerator construction, demolition of the existing 90-ton incinerator and relocation of Highway Department offices occupying a portion of the site. Note utilization of the previously occupied area for residue burial. (Fig. B)

3) Careful control of excavation on the site so that it will be no more extensive than as required by the plant’s residue.

4) Construction of a community building to house a variety of activities.

FIG. D ADDITIONAL BALL FIELDS, TENNIS, DANCING, BARBECUE AND PARKING AREAS
5) Gradual development of the entire site to up-grade the area for community acceptance and utilization of section of the site as landfill operations are completed to provide a completed facility for recreational purposes including:
   a) Horseshoes, shuffleboard, softball and game areas. Tennis, badminton, handball and basketball courts, natural ice skating rink for winter use and a roller skating rink for summer use with paths connecting to other site activities. (Fig. C)
   b) Baseball, additional tennis, teen-age dance and barbecue area and additional parking. (Fig. D)
   c) Band shell, soccer field, interconnecting paths to other activities and completion of the entire site development. (Fig. E)

6) Re-evaluation in 1970 of the projection to 1975 in order to establish, on the basis of records kept in the intervening years, the town's needs for refuse disposal. Below are photographs of some contemporary incinerator plants to illustrate pleasing, functional design.

REFERENCES

FIG. F  AN EXAMPLE OF ATTRACTIVE MODERN INCINERATOR DESIGNS – 600-TON PLANT AT NORTH HEMPSTEAD, NEW YORK, DESIGNED BY LEONARD S. WEGMAN CO., CONSULTING ENGINEERS

FIG. G 300-TON PLANT, VILLAGE OF ISLIP, NEW YORK SURROUNDED BY BERM CONSTRUCTED TO SCREEN UNLOADING AREAS, DESIGNED BY CAMPBELL & FRIEDLAND, CONSULTING ENGINEERS

FIG. H PROPOSED DESIGN FOR VILLAGE OF HEMPSTEAD, 250-TON PLANT DESIGNED BY CAMPBELL & FRIEDLAND, CONSULTING ENGINEERS