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Integrated Solid Waste Management In Hong Kong

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ABSTRACT

In November of 1997 an invitation was received to participate in a seminar in Hong Kong, that was concerned with solid waste management practices that are used outside their respective area.

The thrust of the seminar, was to examine waste disposal techniques that are being employed throughout the world, and evaluate same for future use in the Chinese empire. Representatives from the Hong Kong area which is a quasi-democratic form of government, and from mainland China, which remains a communistic government were present in the audience.

The invitation was accepted, and a 7 day visit to Hong Kong was made, during which time, the seminar and discussions with the Chinese about solid waste practices was held. There was an opportunity to tour a number of Hong Kong disposal facilities.

The experience was interesting and informative, and it provided an opportunity to learn the history of the area, tour the modern city of Hong Kong, and be a part of a program to acquaint the representatives of Hong Kong area and mainland China with waste disposal techniques that are used in the US. The final incentive was the opportunity to obtain a better understanding of the waste collection and disposal systems used in Hong Kong. The paper examines some of these topics in greater detail.

Introduction

As you may be aware, Hong Kong is a nation in itself. It has maintained independence from other nations throughout the world for more that a century, however, in has been influenced deeply by the British during that time. Hong Kong is literally on the other side of the world from the United States, and in terms of travel, it is close to 10,000 air miles from Detroit. The direct flight to Tokyo Japan and the subsequent shorter trip to Hong Kong requires about 14 hours. There is a 13 hour difference in time, and Hong Kong is almost one day ahead of the US.

Hong Kong is an island that consists of less than 100 square miles of land. It is located directly below the southern tip of mainland China in the South China Sea area in the Pacific Ocean. The Hong Kong area has about 6-1/2 million people, and the literacy rate for all is quite high. Children are required to attend school until their fifteenth birthday. The people in Hong Kong speak English, for the most part, but, it is not uncommon for some to speak many different languages, including various Chinese dialects.

The climate of the area is warm and semi tropical, with a short cool season with little or no frost. There is a typhoon season during which the water in the Pacific Ocean becomes extremely rough, to the point where sea going vessels must seek safe harbor areas for protection from the storms. Hong Kong has one of the best seaports in the world because the water in the protected port in the Victoria Harbor area of the South China Sea is very deep and will accommodate the largest shipping vessels. Victoria Harbor is more calm during the severe typhoons because of

the protection offered by Hong Kong Island, and many ships seek the area and consistently take refuge there. Hong Kong is also known as one of the busiest seaports in the world, and the ship traffic in the area is overwhelming. The vigorous amount of shipping contributes to the ongoing positive climate toward private business in the area, and it is said by many that Hong Kong has one of the liveliest economies in the world. It has been that way for more than a hundred years.

The history of how Hong Kong became the area that it is known as today is very interesting.

Hong Kong was an integral part of China, since the beginning of the Chinese Empire many centuries ago. It remained a part of China until the mid part of the nineteenth century, when the Opium Wars were fought between the Chinese and the British. As it is today, at that time the Hong Kong seaport was very active, and vast amounts of shipping flowed through the region, some which involved the movement of opium from India into the Chinese nation.

As a result of the flow of opium into China, its use became widespread among many of the Chinese people. Because of the debilitating effect that the opium had on the people, the Chinese Emperor developed a concern about drug addiction. He organized rehabilitation programs and encouraged the people who had become addicted to enroll in the programs in order to shed the habit of smoking opium. In addition he took steps that were intended to prohibit the shipment of opium into China.

The Chinese knew that much of the opium was being brought in by large ships from other countries, many of which also carried legal trade items. The sale of the opium from the clipper ships to the Chinese opium peddlers occurred at one or the other of the many small outlying islands along the Chinese coast, where the shipper would meet with the clandestine Chinese buyer who would purchase the opium, and in turn resell it to the Chinese citizenry. China opted to stop the drug flow by seizing opium shipments from the clipper ships. They proceeded to do so, and impounded a significant quantity from an English ship. In response to the seizure of the cargo by the Chinese, the British came to the Hong Kong area to protect their commercial ships by escorting them to their destinations with large British warships. The Chinese countered, but their ships, which were known as junks, were no match for the strong warships, and were badly beaten in the naval battles that followed. The Chinese were totally defeated very quickly. England won the war.

A few years after the first war, a second war, which was similar in nature was fought, and again the strong warships sent to the area by the British, and the French, easily defeated the Chinese ships. Having lost both wars, the Chinese were placed in a very poor position, and forced to make heavy concessions to England. Among the major concessions that was made, was the loss of the land in Hong Kong, along with what is now known as the New Territories, a total of about 400 square miles, which extends approximately 30 miles into the southern tip of mainland China. Formal treaties were signed in which the British would rule these areas for 150 years, or until 1997, when a 50 year transition period commenced, during which the Chinese would gradually recover the ownership of Hong Kong and the New Territories. During the transition period the Chinese government would avoid any radical changes in the Hong Kong area, or its political or governmental structure, which is now a democracy of sorts, until the 50 year transition had passed. July 1, 1997 marked the beginning of the first year of the 50 year transition period.

The transition was underway at the time of the visit to Hong Kong, and although there was concern about changes that may occur, the county was not visibly affected. The governmental structure was solid, the economy of the area was strong and vibrant, and the people appeared to be content with their situation.

The Seminar in Hong Kong

Information was presented in the Seminar on Municipal Integrated Municipal Waste Management Systems, that was concerned with ways that solid waste is handled in the US, and more specifically, in the State of Michigan. Throughout the day of the seminar, a number of presentations were made, and many in a language other than Chinese. These were translated into Chinese and other languages to enable communication to all of the attendees. The following information is a synopsis of the presentation that was made at the Seminar in Hong Kong on November 25, 1997. Certain additions have been made to the content to include events that have occurred since the

presentation in Hong Kong, while other parts of the talk have been condensed for the sake of time. The thoughts and conclusions, however, remain consistent with the Hong Kong presentation.

City Management Corporation (CMC) is an American company, with annual revenues of \$250,000,000. CMC is involved in the solid waste collection and disposal business in the United States, in the state of Michigan. There are three main areas of CMC's business that will be discussed in today's talk.

The first is about techniques that are used for **Separation of Certain Waste Products** from the waste stream. These products have an alternative use or a resale value, and if not removed from the waste stream, would otherwise be finally sent to the disposal site.

The first step of the separation process is to identify the products that have a value, and can be removed, and confirm that the value is great enough to equal the cost incurred in the removal process.

There are four waste products, including paper, metal, glass, and plastics, that are considered. In other specific situations, where there is an abundance of a certain waste product, that particular product will be removed. A good example is the removal of yard wastes such as grass and leaves, or the removal of wood, cloth, or plastics.

Yard wastes can be removed from the waste stream, composted, and ultimately used as a source of humus product.

Non-ferrous metals such as copper, brass, and aluminum are most profitable to remove from the waste.

Paper products such as office papers, corrugated containers, and newspapers, will generally qualify.

The four basic products are subject to very cyclic market rate changes, however, that can exceed 500 to 600 percent.

For corrugated and newspaper, the change in market value can range from \$20 to \$200 per ton. The current rate per ton, in the Detroit area, for corrugated is \$40, and newspaper is worth \$35. Copper sells for \$0.60 per pound, aluminum is \$0.20 to \$0.30 per pound, and ferrous is in the \$50 to \$60/ton range. Waste glass or cullet, that has been color sorted into clear, brown, and green colors, is worth from \$5 per ton for green to \$35 per ton for white, and the buyer will pay the transportation costs to deliver the glass to the location where it is to be re-used. Plastic products vary greatly in value, and the quality of the final product is usually very demanding. The plastic is generally divided into four grades, and when baled, the sale price, can range from \$60 for lower grades, to \$120 per ton for the best grade which is natural color HDPE. In certain instances, where the opportunity is presented, other special wastes that have value may be found in the waste stream, and can be removed. A good example is the soft drink and alcoholic beverage containers that have a \$0.10 per container value, but are discarded in the trash, in the State of Michigan. The containers, which are made of plastic, aluminum, or glass, have a scrap product value of less than 1 or 2 cents each, are retrieved at Material Recovery Facilities, and sold for the returnable deposit value of 10 cents each.

It is important to remember that the saving in waste transfer and disposal expenses that results by not having to handle the products that are removed for recycling, will always be substantial, and in many instances, will be the deciding factor that the engineer considers for the development of the basic design of the waste handling and separation processes.

The second topic for today's discussion is **Recycling Systems**.

Many different recycling systems are available, and the most elementary form consists of a simple drop off area, that is unattended, and equipped with a container that is divided into three or four individual compartments, that are used to accept the paper, metal, glass and plastic products that are brought to the center by the users. The recycling center is made available to residents of the particular community who sponsored the program, who are instructed to separate their recycle products at the homeowner level, prior to delivery to the drop-off center. Such programs make recycling available to those who want to recycle, with a very low capital investment, and with the lowest achievable operating cost. Participation in the drop-off programs can be very low, and the percent of products that are removed from the waste is tolerable, because of loss of marketability due to cross-contamination, or commingling of the different kinds of recycle materials. When the steel container is filled, it is hauled to the final destination, which is usually a Material Recovery Facility (MRF), where the recycle contents are finally sorted,

and processing and shipment to market is performed.

The procedure described above, or a similar variation of it, can be placed in a stationary building, to create a more permanent installation, that can operate in inclement weather conditions..

Commercial or industrial recycling can be performed at the point of generation of the waste, in a retail store or factory.

Where there is an abundance of recyclable products that will be available for a long period of time, a MRF can be constructed and operated.

These facilities, can be designed as a dirty MRF, which will accommodate the acceptance of mixed waste that have the recyclables commingled in the waste stream, or, as a clean MRF, which accepts recycle products that have been removed from the waste prior to delivery to the MRF. Both types of MRF employ the use of extensive stationary material handling systems that include equipment such as vibrating and belt conveyors, magnets, screens, vacuums, storage bins, paper balers, and waste compactors.

The location of the material recovery facility should be dependent on the service area, along with good road access, available utilities, and the proximity of the final disposal area.

Availability of personnel should be considered when siting the facility.

Market points for the recycle products have to be identified, and the availability of railroad and trucking services will be needed for good marketing results.

In all MRF operations, equipment selection for a wide variety of in-plant stationary equipment, and other support equipment such as end loaders, fork trucks, and containers that will be a part of the material recovery facility operation, will be a very important part of the overall process.

The last topic of discussion for today will be the **Operation of Solid Waste Transfer Facilities.**

The first consideration for utilizing a refuse transfer facility is the daily capacity of the system, which must be matched with the expected daily waste load, and consideration given for back-up capability to account for equipment downtime or other mechanical or electrical failures.

Location, and good road access are critical factors because the major objective when operating a waste transfer facility is to reduce the haul distance for small trucks that are used to collect wastes from source of waste generation. By reducing the haul to the waste unloading point, the truck and crew gain productive time to perform additional waste collection work. The savings are immense in a large city where the disposal site is located far away. By permitting solid waste route collection vehicles to quickly unload at a convenient solid waste transfer facility, maximum savings are realized. In many instances, route collection crews and equipment can greatly increase their production capabilities, thereby reducing the labor and trucks required to collect the solid waste. Further savings result from the reduction in truck maintenance costs, as the route collection trucks are not subject to body and power train damage that occurs when trucks are operated on poor roadways at the landfill disposal area.

Experience indicates that the years of useful life for the solid waste collection trucks will double or triple when utilizing a solid waste transfer facility, instead of going directly to a remote landfill disposal area.

In other applications, where limited solid waste collection services are available, a small transfer facility, that consists of an enclosed compaction unit, and a companion container, that is usually attended when open for business, is used to accept waste directly from individuals in the service area. This is commonly done in a number of sparsely populated rural areas, such as northern Michigan. The objective is to avoid the long drive by residents to the landfill, and avoid damage to automobiles or small trucks, that would occur while at the landfill site.

Utilities are needed to support the waste transfer operation and must be available. Electricity, communications, and water and sewer will be necessary.

The solid waste transfer facility should be compatible with surrounding neighborhood, as neighbors must be persuaded to accept the location and operation of the facility. Provisions for setback areas, use of buffer zones, and construction of earth berms and tree lines are all beneficial for establishing better degrees of isolation. In many instances, incentives are given to those who are directly impacted by the operation of the transfer facility, in order to maintain their ongoing approval.

A large amount of thought and study is usually given by the engineers who are charged with the selection of the basic design of the facility, in order to tailor it to the needs of the community.

The configuration of the waste receiving area, so it will meet the requirements of the trucking methods used to collect and unload the waste, recognition of the types of solid waste to be handled, and the daily quantities of same are important factors.

The hours of allowable operation that the facility will be available to the user is a vitally important point, and can add value to the serviceability of the system.

The design of the material handling system is the core of the operation, and will impact the long term success of the facility. Experience has shown that the most successful operations are those that are strong and durable, easy to repair, have good availability of spare parts, have high production capability along with ease of operation, and operate with reasonable numbers of employees.

The ability of the waste transfer system to rapidly unload and reload the solid waste, from the incoming trucks, onto the trucks used to haul to the disposal area, is a major concern. Depending on the condition of local roadways and the road weight limits, steps may have to be taken in the design and equipment selection phase of the engineering work to include stationary loading and compaction type equipment that will produce a controlled method of loading and compaction of the waste. This procedure can assure that trucks leaving the facility are loaded sufficiently, while staying within the allowable weight limitations. Inclusion of the MRF capability to permit separation and recycling in the transfer station area is a distinct advantage, and worthwhile to consider in the design of a new facility.

Record keeping for incoming loads of waste is accomplished with the use of an electronic truck scale and attached computer system, and all truckloads are weighed as each enter or leave the facility. Incoming loads of waste, as well as outgoing loads of recycle or solid waste products are weighed. The computer system is equipped with custom software that is programmed for solid waste scale applications, and it is used to create permanent scale records that are finally used for record keeping and billings to customers, as well as income due from the sale of recycle products.

A considerable amount of time and effort is spent at the solid waste transfer facility to develop and implement good environmental practices to assure that steps are taken to keep environmental degradation at a minimum level, and that all regulatory guidelines are met. Care has to be taken to avoid the release of excessive amounts of dust, noise, odor, and dirt track-out by trucks leaving the facility.

Careful selection of waste processing and loading systems, and hauling equipment that is used to move the solid waste from the transfer facility to the disposal area is necessary, to assure a proper match for the application. Each round-trip to the landfill should move maximum tonnage.

Accounting routines used to purchase supplies, perform banking activities, invoice customers for services rendered, and pay employees, have to be established. Traditional accounting methods are generally used.

Separation of waste products, development of recycling systems, and refuse transfer facility planning have been discussed in detail in the session.

As a closing remark, there is one particular point that has not been emphasized and should be, and that is the value of thorough education of the public, who will be the users of the systems that are developed. Experience has shown that in each instance where extensive public education is performed, the long term results are very positive. In other situations where the solid waste operation has come under negative scrutiny, extensive public education and involvement, have proved very beneficial in understanding the issues, and formulating a resolution to same.