OAHU MUNICIPAL REFUSE DISPOSAL ALTERNATIVES STUDY

NEW SYSTEMS RESEARCH FOR REFUSE DISPOSAL

APRIL 2000

PREPARED FOR:

CITY & COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
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Honolulu, Hawaii 96813

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In Association With

Allied Technology Group, Inc.
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And

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EXHIBIT K145

EXECUTIVE SUMMARY

1. BACKGROUND

The New Systems Research (NSR) task evaluated the feasibility of various alternatives to divert refuse currently being sent to the Waimanalo Gulch Landfill. The City and County established the following objectives for this study.

- The technology must process waste materials being disposed in the Waimanalo Gulch Landfill.
- The technology must be operating at full scale and processing the amount of material expected at Waimanalo Gulch.
- The net cost of the technology (after credits for the revenue from the products of the operation) must be no greater than the fee paid for disposal.

The task is performed by first gathering data on the City and County of Honolulu (City) refuse management system, its requirements and its objectives. Next, a model of the City's management system is developed to aid the technology evaluation and screening process.

The evaluation of the technologies was initiated by conducting an extensive survey of the available systems. Next a two-tier screening process is used to first narrow down the survey results to seven and then from seven to a set of short-listed technologies. In order to allow a more detailed evaluation, a pre-conceptual plan was developed for each of the three short listed technologies as an integrated refuse diversion facility with all of the ancillary systems needed. The integrated facilities that passed the second tier technical screening are:

- Oahu Municipal Refuse
- Disposal Alternatives Study

Information on a third technology is also included, although it did not meet the past operating and economic performance criteria. This technology is the Plasma Generating Station. It was included due to its advantages and apparent potential to qualify under the City's criteria in the future.

Pre-conceptual designs for each of the integrated facilities are presented later in this report. Each of the pre-conceptual designs include a system integration block diagram, a facility functional block flow diagram, and a facility plot plan. The pre-conceptual characterization of the options also included the functional, operational and performance aspects of the overall facility and its key unit operations. Based on the pre-conceptual characterization of the facilities, rough order of magnitude (ROM) capital and operating costs for each of the alternatives are developed.

2. CONCLUSIONS

Although they do not achieve all of the City's objectives (they all fail the cost objective), the alternatives considered are highly effective in diverting refuse stream from the Waimanalo Gulch landfill. Preliminary study results show that these alternatives can be implemented without requiring major changes to the existing City refuse management system. The most promising alternative, plasma-generating station, could potentially divert as much as 90% of the estimated 278,000 tons refuse being sent to the landfill. If this alternative were implemented, the only major waste stream requiring disposal would be the H-POWER ash, which is estimated to be approximately 108,000 tons per year. The other two alternatives, the metal and gypsum recycling plants, have a potential of diverting 11% and 7%, respectively.

One of the most "problematic" materials in the waste stream to the landfill is treated wood. This waste contains potentially toxic materials that limit the options for volume reduction or recycling. Hence, any thermal technology employed to process the wood must contend with the toxic metals emissions. The plasma gasification/vitrification technology offers the most advantageous solution in dealing with the toxic contamination in the treated wood stream due to its high operating temperatures, embedding the contaminants into a vitrified glass material, and ease of capturing emissions.

The plasma generating station and gypsum recycling plant will convert refuse to products that could be sold in the Hawaii region market place. It is estimated that the plasma generating station will produce approximately 900 kwh of electricity per ton of refuse processed, with 300 kwh available to be sold. The gypsum produced can be sold as an agriculture soil additive, animal bedding, and an oil absorbent product. The product from the third alternative, metal recycling plant, must be shipped offshore for recycling.

Currently there are no large capacity municipal gasification/vitrification installations based on direct current (DC) arc plasma systems. The largest operational DC arc plasma system is

approximately 10 tons/day. These systems have been used in (or proposed for) mostly hazardous and medical waste applications in the U.S.

Metal recycling is a common technology that is employed by all industrial facilities generating scrap metal and most municipal refuse systems. A literature survey indicates there are a minimum of two gypsum recycling plants operating in the U.S.

The plasma generating station would require both air emissions and water discharge permits. The metal recycling and gypsum recycling plants are expected to require only air emissions permits for their baghouse dust collection exhaust streams. Environmental impact assessments would also be required for the three alternatives.

We estimate that it will require 70 months to acquire the plasma generating station and 32 months for the metal and gypsum recycling plants. Assuming a privatized ownership of the facilities, the estimated net revenue (including sale of all products and payment of the full disposal tip fee) per ton of waste processed at plants using the three technologies are:

- negative $28 per ton for the plasma generating station
- negative $29 per ton for the metal recycling plant, and
- negative $39 per ton for the gypsum recycling plant.

Using the estimated price for electricity, these technologies are between 22 and 54 percent more costly than the current disposal fee. Using the actual price now paid to H-POWER for sale of electricity, the increased cost is between 30 and 54 percent greater.

The City required that a technology have a proven track record in all aspects of implementation, including technical, permitting and cost-effectiveness and be less costly than the disposal fee. The study concludes that none of the three technologies meet the City's criterion.

The Plasma Generating Station alternative based on a DC arc plasma technology has not been used in municipal refuse applications and has a net cost of operation greater than the fee for disposal. Hence, it does not meet the City's criterion. Both the Metal Recycling Plant and the Gypsum Recycling Plant have a net cost of operation greater than the fee for disposal.

In the interest of providing information to assist the City should it review alternatives to the current disposal methods in the future, we have included our technical analyses in this report. The details provided here should enable the City to narrow the focus of future evaluations.

3. RECOMMENDATIONS

The primary conclusion of this evaluation is that there are no technologies now available that provide an alternative to the current disposal system and achieve the City's three objectives.

If the City decides to proceed despite none of the technologies meeting its criteria, the next milestone should be a "go/no-go" decision on a "focused feasibility study" aimed at better understanding the nature of the three candidate technologies. It is believed that the diversion and recycling capabilities of the candidate technologies are highly promising and, hence, a "go" decision is warranted.

The focused feasibility study should further develop the concepts proposed herein. The focused study should emphasize the salient features of the alternatives, including issues that attract private investors. For example, the technical, permitting and economic risks associated with the selected technologies and the availability of a market for the recycled product must be thoroughly investigated so that an interested private investor is able to make an informed decision on potential investment.

In conjunction with the focused feasibility study, it is recommended that a survey be conducted to identify alternative sites for locating the plants. Furthermore, public and business relations efforts are needed to solicit private sector investors and companies.

One of the alternatives considered by this study, the plasma generating station is uniquely compatible with the City's refuse diversion needs. The limited availability of land space, the highly protected environment, and limited energy resources are the three reasons that lead to recommending the plasma gasification/vitrification technology as the ultimate solution for the future refuse disposal space problem. This innovative and first-of-a-kind technology promises to be environmentally friendly, produce the much-needed electricity for the region, and significantly reduce the City's landfill space requirements. After this alternative has been proven in a full scale plant operating on municipal solid waste, it is recommended that further feasibility studies be conducted to provide a better understanding of the technology's reliability, operability and cost-effectiveness.

Gypsum recycling is an innovative and new use of commonly available machinery for pulverizing gypsum and separating the facing paper. The major barrier for implementing this option is the market for the gypsum. Therefore, it is recommended that market research be conducted to ensure that recycled gypsum can be sold on the island.