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**Report on Trip to Japan
Hitachi Metal Plant in Utashinai
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U.S. Science and Technology (USST) invited local governments and independent scientists to inspect the plasma arc gasification (PAG) plant in Utashinai, Hokkaido, Japan. Tour attendees included officials, staff and consultants from Minnesota, Sacramento, Greece, Great Britain and Canada. PAG has enormous potential as a safe and efficient technology to manage municipal solid waste (MSW) while generating energy and useful byproduct materials. Sacramento City is engaged in objective analysis of this technology and how it might be appropriately adapted and applied to meet the City's need for sustainable growth.

Background

The City of Utashinai is found on the northern Japanese island of Hokkaido. The City had a long and prosperous coal mining history. During the last half of the 20th century the mines began to close amid dioxin fears and other municipalities were formed. In the presentation Mr. Osada, General Manager of the Utashinai plant, explained that the Hitachi Metals, Ltd. was looking for a new environmentally safe business. The residents demanded assurances that the high levels of dioxin from the previous mining operations were not going to be duplicated in this new industry. Waste disposal, both municipal and auto, were a growing problem as they are on most islands. The City of Utashinai, Hokkaido Coal Mining, the Japan Regional Development Corporation and the Development Bank of Japan formed a public/private partnership called the **Eco Valley Utashinai Company**, managed by Hitachi Metal Ltd. Each partner invested funds to build and run a waste to energy plant using plasma arc gasification.

Environmental Process

Japan's environmental review required Hitachi to build a prototype plant and operate it for one full year. The government created new standards to help reduce possible dioxin emissions. The plant can not emit more than 0.01 nanograms of dioxin per 100 tons of waste a day.

There are emission limits for dust, soot and nitrous oxide as well. Our local and state air quality regulators will have to verify what our safe levels are.

Operations

Municipal solid waste (MSW) and auto shredder residue (ASR) are the feedstock used to convert the waste to slag and synthetic gas. Hitachi receives municipal solid waste from five cities, and contracts with four cement companies for the ASR slag, which is used for roadway material. The plant generates 4,300 kilowatts (kw) of electricity, which is well below their stated goal.

The solid waste (without food) and auto shredder residue are deposited at the refuse pit. The MSW and ASR are mixed together and shredded before being dumped into the feeder for the plasma arc tank. Originally the ASR and MSW were processed separately. This plant has a duplicate system, one for each. Hitachi has switched to a mixed system for maintenance purposes. There are four plasma arc torches per tank that vaporize the waste. Limestone and some coal are used to facilitate heating the feedstock (waste). The residual material becomes slag or synthetic gas. The slag is cooled by water and turns into a dark hard substance. The gas is treated and cooled becoming steam for electricity. The plant has air fans at the waste feeder and plasma arc tanks followed by the after burners, then the boilers. The syn gas is moved to a steam turbine for electricity. Both the slag and syn gas are moved to air preheaters then cooling towers. A fly ash tank is used to capture toxins, as are two sets of bag filters. The slag is treated and the residue is sent to the induced draft fans before release to the smoke stack.

Conclusion

There is no other known plant in the world using PAG with MSW feedstock at 165 metric tons a day. USST is proposing to build at no cost to the City a 200-300 ton per day facility. This is certainly an opportunity for new revenue to the City, but safety is the number one priority. The City of Sacramento must continue its due diligence, and an additional 90 days of fact finding with USST is in order. We need a better understanding of Japan's environmental review process. And, our Economic Development Department has to analyze the feasibility of electricity generation.

Many of the questions submitted to USST were answered during the site visit. A table reflecting the emission standards is shown in Figure 1. The waste stream is 50% MSW and 50% ASR. However, many new questions were raised. For example, why is food waste not accepted by Hitachi? What is the impact of Hitachi not exporting electricity at their stated goal? USST must determine if there would be a significant difference to the feedstock with putrescible waste. The City's commitment of 500 tons per day of MSW contains food waste. We will continue to need third party analysis of the answers.

The trip was worthwhile and a follow up is necessary. The City delegation for the second trip should include third party experts from our technical team, staff from CAL – EPA, Sacramento Air Quality Management District, Economic Development, Solid Waste, City Management, a Councilmember and an environmentalist (perhaps from the Sierra Club). In addition, the Solid Waste Division should be given the opportunity to visit a Japanese municipal solid waste operation.

Emission limits (Flue gas--Dry gas: corrected to 12% oxygen)

Dust	0.04 g/m ³ n	2 stage catalyst bag filter
SO _x	17.5 (K-value)	Dry toxic gas elimination--slaked lime
NO _x	250 ppm	2 stage catalyst bag filter
HCl	430 ppm	Dry toxic gas elimination--slaked lime
DXN	0.01 ng-TEQ/m ³ n	2 stage catalyst bag filter

Figure 1 Emissions Table



Figure 2 Municipal solid waste staged for shredding



Figure 3 Solid waste lifted to shredder



**Figure 4 Molten slag from chamber
(Photo courtesy of John Howard III)**

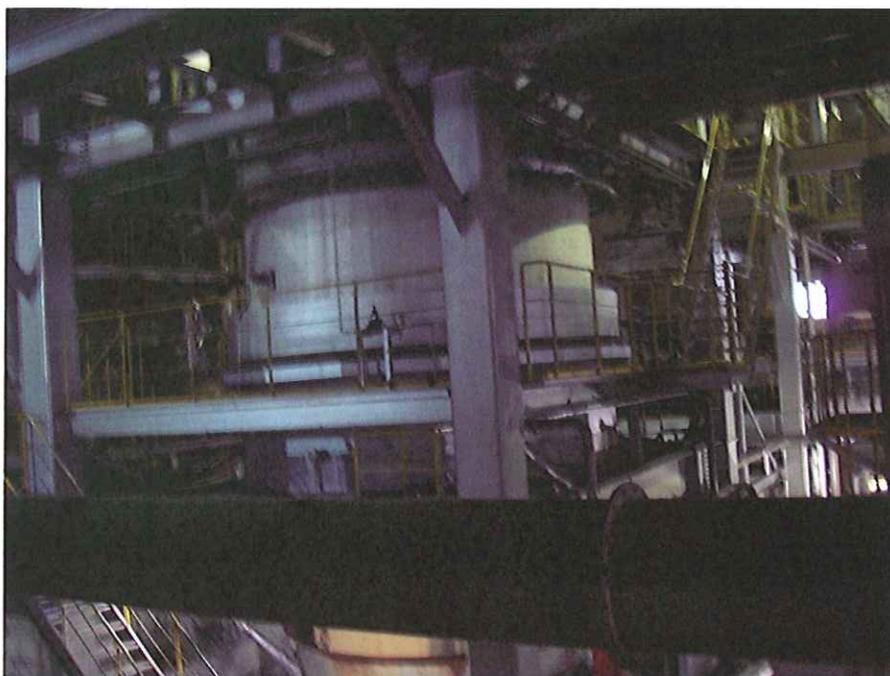


Figure 5 After burner that filters synthetic gas.



Figure 6 Cooling fans for steam



Figure 7 Stack