Zoo Animal Waste-to-Energy Project Summary

A source of biomass material for direct or indirect co-firing with coal that has not received much attention is zoo animal wastes. There is virtually a zoo in every metropolitan city in the United States. The amounts of wastes produced by the animals in these zoos and the energy that can be derived from them are quite significant. For example, for the zoo in a mid-size city like Knoxville in Tennessee, animal wastes production is about 40 tons per week. Animal wastes have an energy value for direct combustion, just like many other organic compounds such as solid wastes from municipalities. There has been very little experience in the direct combustion of animal wastes, either by themselves or as a supplement to some other organic fuel source such as coal. Discussions with the main power supplier in the area, TVA, has indicated that the type of waste generated by the Zoo, is not compatible with the type of burners used in the local vicinity. However, indirect co-firing of gases from an anaerobic digestion lagoon may be feasible. A more attractive option is to locate the digester at the Zoo for energy and/or heat generation.

To investigate the feasibility of using elephant and rhinoceros dung for methane generation, a team of investigators from the Knoxville Zoo, Tennessee Valley Authority, private consultant, Tennessee Department of Economic and Community Development, Energy Division, and Oak Ridge National Laboratory was formed. Their responsibilities were as follows:

Knoxville Zoo: The Zoo will provide the waste material and cost information about alternative disposal methods such as composting or landfill, as well as participation in meetings. The Zoo will also investigate the potential use for waste biomass for composting or fertilization use.

Tennessee Valley Authority: TVA will have an input on experimental design and conceptual design of a large anaerobic fermentation system. They also will evaluate the potential of using reciprocating constructive wetlands to process wastewater from the digester.

John Sicard: John Sicard is a construction consultant for the renovation project at the Zoo with an interest in renewable energy resources. Sicard will make an initial estimation of costs and benefits for an anaerobic system, either at the Zoo or at a TVA boiler facility.

Tennessee Department of Economic and Community Development, Energy Division: The Energy Division has expressed interest in the project and the project will support the Tennessee bio-based business objective.

Oak Ridge National Laboratory: ORNL will conduct literature search and experimental activities for the anaerobic digestions of zoo waste. The results will generate information such as rates and yield of methane on the waste biomass.

Current Progress:

The experimental work at ORNL has been completed. Both types of animal dung were found to be good sources for methane generation. The methane yield values were comparable to those obtained by other investigators for dense animal wastes such as camel and horse manure. The results were reported at the 24th Symposium on Biotechnology for Fuels and Chemicals in Gatlinburg, Tennessee (April 28-May 1, 2002).