

## DENSIFIED REFUSE DERIVED FUELS - AN ALTERNATIVE CONCEPT

by

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### Introduction

The use of refuse derived fuels (RDF) has been demonstrated and is on the verge of being commercially implemented at St. Louis, is commercially implemented at Ames, Iowa, and is being considered by other communities. The form of the RDF in these projects is fluff, i.e., the air classified light fraction of shredded municipal solid waste. Although certain technical and institutional uncertainties may remain for implementing this concept at selected sites, the technology has probably come of age. Because of the relatively high costs associated with designing, constructing, and operating facilities for recovering and using the fluff RDF, the concept may be limited to the larger municipalities. Ames may be an exception, but economics have not yet been established for the Ames process. Additionally, the municipality must be sufficiently large to supply the quantities of refuse required to support the power plant requirements for the RDF. Another potentially bad but undefined situation that might develop for selected municipalities using the concept is that they could become locked into a single technology for managing their solid waste and their potential outlets for resources recovered from the waste. This could result because of long-term commitments to the utility for supplying the RDF and the utilities rate-making policies and regulations. This situation could possibly result in communities paying more for managing their solid waste than might result from other alternative and more flexible techniques.

The purpose of this presentation is to discuss an alternative concept to fluff RDF. This concept involves the use of densified forms of RDF (d-RDF) as a substitute fuel with coal in smaller utility, institutional and commercial-type boilers. Basically, processing of the municipal solid waste (MSW) for producing d-RDF involves primary shredding, air classifying, secondary shredding of the light fraction, and densification. Densification may be by pelletizing, briquetting, or extrusion. While processing steps may change for specific reasons, the fraction of the MSW to be eventually densified will be the shredded organic fraction, cleaned of glass, metals, grit, and abrasive materials to the extent possible within technical and cost constraints. Because of the attractiveness of this resource recovery concept as an alternative market for MSW, EPA has implemented programs to investigate the environmental and technical aspects of the concept.

## The d-RDF Concept - Advantages and Disadvantages

As stated, the d-RDF concept involves the burning of densified RDF in stoker-type boilers smaller than those boilers generally associated with the St. Louis project. These smaller boiler facilities, say in the 11,340-90,720 kgs (25,000-200,000 lbs) of steam/hr range, may not be large enough to support the costs associated with converting to use fluff RDF. Additionally, because of their size, they are usually unable to buy primary fuel in large volume lots, and therefore, often pay premium prices for fuel. Therefore, if such a facility could obtain an RDF fuel which could be blended with the coal or otherwise satisfactorily handled with acceptable storage characteristics, and could be burned satisfactorily with minor modifications to the facilities, the refuse fuel would be worth more to those smaller users than to the larger utility user. And because sufficient numbers of this size stoker-type boiler facilities are located near refuse sources, markets for the recovered combustible refuse are potentially expanded. The combustible fraction of MSW then becomes a more valuable product for resource recovery operations. Increased storability and transportability may also result from converting the fluff to d-RDF and may add to its value as a fuel.

Disadvantages to d-RDF may lie in its cost of production. If production costs are excessive, they may more than compensate for the added value of the refuse, and result in an uneconomical operation. The key here appears to involve requirements for preprocessing of the waste prior to densification and the cost of densifier operations. Also, costs of transporting the d-RDF to user locations will be an important factor. These all assume that the boilers will be able to burn the d-RDF without major modifications—something that has been indicated in test trials but which has not been verified by detailed experimental test burns.

## EPA Programs in d-RDF

The U.S. Environmental Protection Agency has long been interested in the d-RDF concept in the establishment of acceptable alternative solid waste management technologies. If proven to be technically and economically feasible and environmentally acceptable, the use of d-RDF could prove to be an exceptionally attractive resource recovery option for many communities, including those normally considered too small. Because of this, the U.S. EPA has undertaken a program to establish the environmental, technical, and costs associated with producing d-RDF and burning it as a fuel in industrial, utility, and institutional stoker-type boilers. This is not to imply that the basic concept is EPA's, as the use of a briquetted d-RDF of office waste paper was successfully burned in a municipal utility boiler in Fort Wayne, Indiana during 1972. Also, there have been other recent successful tests at Palmer Township, Pennsylvania; Oshkosh, Wisconsin; Chenuite AFB, Illinois; Wright-Patterson AFB, Ohio; and others. However, despite these successful trials, little testing results and operational experiences have been published. EPA felt that for this alternative concept to become widely implemented a number of credible experimental tests would be required to fully characterize the

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environmental, technical, and economical aspects of the concept. Of major importance would be the effects on boiler facilities, their operations, and the environment from burning the d-RDF.

Briefly, the current EPA d-RDF program consists of two concurrent, but integrated projects. Under a research grant to the National Center for Resource Recovery (NCRR), studies are being conducted to determine the production requirements for a specification d-RDF. These studies include determining the cost of producing the d-RDF. Under a competitive contract awarded to Systems Technology Corporation, the second study involves detailed evaluation of the combustion characteristics of the d-RDF, including its effects on emissions, boiler operations, fuel burn out, ash generation, boiler corrosion, fuel handling requirements, and associated items. Commonalities to both projects will exist throughout the course of the studies, as constant transfer and feedback of technical observations will be required among the various investigators. This is needed in order that the d-RDF materials handling properties, optimal configurations, densities, size, and the many, many other properties can be adequately defined.

The overall EPA program objective is to provide the necessary experimental data and operational experiences to interest potential users in establishing programs to implement the concept. More specific objectives, not necessarily in order of importance, are:

1. To establish the minimum equipment modifications necessary to utilize d-RDF in existing stoker-fired boilers. Modifications might well include changes in fuel feed devices, grate speed controls, overfire and underfire air, soot blowers, and dust collectors. The necessary modifications should be specified as a function of the boiler type.
2. To establish the optimum characteristics d-RDF required for combustion in stoker-fired boilers. These must be established from a materials handling as well as combustion viewpoint. Properties of interest are the size and shape of the densified fuel, its density, its moisture content, its mechanical strength, and its constituents. A major factor from the point of utilization might well be quality control, how closely do the properties of one sample or one batch of fuel match the properties of other samples and other batches? And of course, d-RDF production costs and refuse processing requirements will require study.
3. To establish the optimum operating conditions for a stoker-fired boiler burning coal and combined d-RDF. These conditions will include coal-to-refuse ratio, air distribution (primary to secondary), air temperature, excess air level, and preferred coal characteristics. The optimum operating conditions will also depend upon the boiler type.

4. To establish the influence of d-RDF on the boiler performance. Every effort will be made to ensure that the boiler must not be downrated since this may prove a disincentive for the use of d-RDF. Boiler efficiency must be determined as must the efficiency of dust collection and other emission control equipment. Assessment is also required of the fouling and corrosion characteristic.
5. To establish the total environmental impact from the use of d-RDF. This includes the impact on both air and water quality. Water pollution may only prove to be a factor where the ash is water quenched. The fate of trace compounds must be ascertained.
6. To establish the economic impact of burning d-RDF on stoker-fired equipment. This involves not only the impact on the boiler being tested, but an estimation of the overall potential impact of d-RDF as a solid waste resource recovery alternative.

In the final analysis, successful implementation of the concept will depend upon a few key factors. These include boiler owners and operators who must be convinced that the use of d-RDF will be to their benefit, either in an economic or some similar manner; environmentalists who must be convinced that the use of d-RDF will not result in increased environmental problems; and acceptable institutional climate for establishing resource recovery systems capable of producing and marketing the d-RDF; and an acceptable technology capable of producing and utilizing the d-RDF in a manner comparable or better than other resource recovery alternatives.

### Summary

In summary, EPA considers the use of d-RDF as an attractive alternative for marketing and utilizing the combustible fraction of municipal solid waste. It should, however, be considered as a solid waste management concept capable of providing limited quantities of energy on a national basis. Programs have been implemented to evaluate the economical, technical, and environmental aspects of producing and utilizing d-RDF in stoker-type boilers. These projects are designed to provide answers to certain questions relating to d-RDF production and processing needs, product specifications to fit existing hardware, product storability and handling characteristics, effects on boilers and boiler operations, environmental impacts, and the economics of the total concept. Tradeoff points must be established between the benefits of d-RDF use and its total cost of use. These in a sense, represent broad research and development needs in the area of d-RDF.