

Industrial Recycling and Alternative Fuel Program

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Abstract

This pilot study will create an industrial recycling and alternative fuel opportunity for the Department of Energy (USDOE) as well as establish a partnership with the United States Postal Service (USPS) and private industry.

The core goals of the partnership between the USDOE, USPS, and industry are to simultaneously increase business success while, driving down pollution and waste. Concurrent Technologies Corporation (CTC) is developing a baseline to integrate current industrial needs with the waste to energy concept for the Department of Energy. The overall benefit in this partnering venture will demonstrate that federal agencies can operate effectively and efficiently using innovative technologies to meet environmental, economic and stakeholder concerns and needs. A current Waste to Energy Project at Savannah River Operations will be discussed as the basis of this paper and the pilot project.

Introduction

The United States Department of Energy Savannah River Site (DOE/SR) is committed to reducing the amount of material landfilled from the Savannah River Site (SRS). DOE/SR is working with the USPS and regional industry to develop opportunities for the reuse of industrial waste streams. The Federal “right sizing”, rising waste disposal costs, falling recyclables markets, and rising fuel costs combine to create a needs driven opportunity. The challenge is to develop a program that will provide a solution to the rising costs associated with waste management while, decreasing pollution and waste.

Concurrent Technologies Corporation (CTC) is working with the AFP partners to develop a pilot that will recycle the partners existing wastestreams into a cleaner burning less expensive fuel for powerhouses. The program team has identified suitable wastestreams for use as feedstocks and a willing powerhouse to test the alternative fuel.

Specifically the USPS will be given an opportunity to address an otherwise liability of wastes and identify a beneficial niche in the current generation of bulk mail which costs thousands of dollars to dispose of in local landfills. By building a more regional approach for the USPS to address the current need to prevent pollution and waste in landfills, this creates a pioneering effort for excellent business conditions, better industrial relationships with government agencies, and a healthier environment.

The regional private sector participants providing the wastestreams to be recycled by the AFP are representative of the Pulp and Paper Industry. This industry produces a process waste known as residual short fiber (RSF). The RSF has a high fiber and moisture content. The common practice of landfilling the RSF (approximately 100 tons/day per regional facility) is very costly to the industry and consumes limited landfill space.

The Waste Management Department at SRS is interested in reducing the amount of material landfilled and costs associated with management/disposal. SRS has wastestreams that can be easily utilized as feedstocks for an alternative fuel. The utilization of an alternative fuel processing plant would allow the waste management department to commingle numerous wastestreams and greatly reduce related costs.

The DOE/SR is looking at opportunities with the Site Utilities Department (SUD) to reduce costs associated with energy production at SRS. SUD operates the stoker fired boilers at the 784-A Powerhouse facility. The alternative fuel would be available to SUD at significant cost savings to that of coal. Two test burns of the densified industrial wastestreams have been conducted at the 784-A Powerhouse. The results of the test burns will be discussed as well as the conceptual engineering study to determine the technical and economical feasibility of the alternative fuel facility. The development of an alternative fuel processing facility in the region will improve industrial competitiveness by lowering disposal costs, saving landfill space, reducing coal costs, lowering sulfur emissions, and creating new jobs.

Body

The Alternative Fuel Program (AFP) provides an opportunity to shape the future for the USDOE by establishing a team approach with outside industries as well as resolve environmental and economic problems for everyone involved. The AFP is an innovative recycling program that is targeting the waste management needs of regional industry and the fuel needs of the DOE/SR. The program will be beneficial to the environment (save landfill space and lower emissions), reduce industry production costs (waste disposal), decrease cost associated with coal consumption (less expensive fuel), and provide new jobs.

The AFP Partners need to increase the amount of material recycled and reduce the dollars associated with disposal in order to remain competitive. The opportunity to work together and develop the economies of scale will allow the partners to collectively obtain their desired goals. This pilot project will assess the viability of a third party processor

developing an alternative fuel processing plant to serve the potential clients in the region surrounding SRS.

The DOE/SR and the USPS have a large percentage of fibrous material in their respective wastestreams. DOE/SR has wastestreams similar to large private sector industries with substantial administrative and management infrastructure. The unclassified site waste paper (white only) is collected and sorted for recycling off site at a substantial expense. The classified waste paper is shredded and then landfilled off site. The shipping / receiving material and wood waste generated at the Savannah Site is also available. All of the above wastestreams could be expanded, commingled and, accepted as a single feed stock for the AFP. This would substantially reduce the associated management and disposal costs for the various wastes. The majority of the material is mixed grades of paper commingled with smaller amounts of plastic. This commingled waste stream is not easily or cost effectively recycled by conventional methods. The amount of labor required to separate the material into individual grades of paper and types of plastic is far greater than the potential revenue (if any) produced from the sale of the individual recyclables.

Business mailings are the primary business line for the USPS. In order to stay competitive the USPS must reduce the rising costs associated with waste disposal. The undeliverable bulk business mail (UBBM) is one of the largest wastestreams generated by the USPS (undeliverable mail, returned to the post office). UBBM consists of newspaper, magazines, magazines wrapped in plastic, envelopes with and with out plastic windows, flyers, inserts, and other types of direct mailers. The problem with UBBM for conventional recycling is the numerous types of material (various grades of paper and plastic) which requires labor intensive sorting by grade in order to market to individual recyclers. The USPS is not structured to provide sorting of returned pieces of mail. The cost to sort the low value individual grades of paper which comprise the UBBM grossly exceeds the revenue (if any) from the sale of the recovered paper. The conventional recycling companies would not take all of the constituent parts of the UBBM, which would still leave a substantial amount of material to be landfilled. The UBBM is ideally suited for inclusion in the Alternative Fuel Program. The UBBM would require virtually no sorting by the USPS and provide the fuel processors with a slightly higher Btu value from the plastic content. The USPS could send all of the UBBM to the alternative fuel processor for blending with other wastestreams. The processing at the alternative fuel plant would provide its customers with an additional benefit by rendering the feedstocks unrecognizable. The Mid-Atlantic Region of the USPS is supportive of the Alternative Fuel Program at SRS and is helping the team develop an MOU between the USPS and DOE. It is anticipated that a test burn of the UBBM will be conducted in the near future.

The quantity of material generated by the SRS and the USPS (Columbia District) are individually not of significant scale to support a dedicated waste processing facility.

Private industries in the region produce process wastestreams suitable for use as feedstocks for alternative fuel. The Pulp and Paper Industry commonly generate a fibrous

wastestream during the paper making process referred to as residual short fiber (RSF). The RSF is produced in large quantities and has high moisture content (in excess of 60%). This material is typically landfilled at great expense to the generator. The dehydrated RSF has more than two thirds of the Btu content of coal and can be co-fired with coal or hog fuel for power generation. The Pulp and Paper clients would be able to send the RSF and other fibrous wastestreams to the Alternative Fuel Plant for processing at rates competitive to landfills. The proprietary nature of the Pulp and Paper Industry raises concern with legacy and disposition of their wastestreams. The use of the RSF and other wastestreams as an alternative fuel renders the material unrecognizable and addresses most legacy issues. The development of process waste into fuel for this reason has distinct advantages over land application and landfilling.

The Kimberly Clark (KC) Beech Island Mill provided six as is tons of RSF for the first test burn at the 784-A Powerhouse. The RSF was not sent off site for processing, it was sent directly from KC with no drying or densifying to the 784-A Powerhouse for mixing with coal. The primary products produced at the KC Beech Island Mill are tissues and diapers. In addition to the RSF the mill also produces diaper tailings as a wastestream. The diaper tailings combine well with the RSF to increase the overall Btu value of the alternative fuel. KC is an active partner in the Alternative Fuel Program and would like to support a less expensive means of handling their wastestreams.

The first test burn was conducted on October 24, 1996. The RSF and coal mixture was loaded into the Number 2 bunker in order that the mix would begin feeding onto the Number 2 grate at the desired time. No operating problems were noted with the blending or transporting of the mixture. At 1000 hours the 4 to 1 mix was feeding onto the boiler grate. No problems were noted with the mixture feeding from the Number 2 bunker through the volumetric feeder. There were no operating problems noted either with maintaining the steam output or a level bed on the grate. By 1200 hours the 1 to 1 mixture was feeding the boiler. An increase in fuel demand confirmed that the larger percentage RSF mixture was being fired. The test was concluded at 1400 hours, when the boiler was shut down and the Number 1 boiler was started. No operating problems were noted at any point during this test. The operating logs document that stable steam output was maintained throughout the test period. Some increase in the fuel demand was noted. This change was consistent with the decreased Btu content of the RSF/Coal mixture relative to coal by itself. These logs also show that opacity decreased. This was probably due to the larger ash size of RSF, which would increase the filtering capacity of the dust collectors. Also the RSF fibers could entrap coal fines which would keep more ash on the grate. This would reduce the amount of coal ash loading of the dust separators. Lower flue gas exit temperatures were recorded. This effect can be explained by the increased moisture in the fuel from the RSF. The higher moisture would increase the relative humidity of the flue gas. That would increase the specific heat capacity, which would lower the temperature of the flue gas for a given rate of heat release by the fuel. All of the observed effects resulting from the use of RSF/Coal as a fuel were either of no negative impact or some positive effect. The results of this test supported continuing with the second test of cubed RSF/SPF for use as a low cost alternate fuel. 1

Ponderosa Fibers of Augusta, GA supplied the RSF and Shredded Poly Fiber (SPF) for the second test burn at the 784-A Powerhouse. One of the primary business lines of the Ponderosa Augusta Mill is the recycling of poly coated paper (milk and juice cartons). They separate the poly from the paper fiber and reclaim a vast majority of paper to create a pulp substitute. Ponderosa has two primary wastestreams, RSF and the shredded poly fiber. Ponderosa is very interested in reducing waste disposal costs and improving their competitiveness. They sent in excess of 60,000 lb. of RSF/SPF to Fiber Resources, Inc. in Pine Bluff, Arkansas. Fiber Resources is a partner in the program and has been processing alternative fuel from similar wastestreams for fifteen years. The wastestreams provided by Ponderosa were both approximately 35% solids. Fiber Resources dehydrated both materials to approximately 85% solids. The reduction in moisture is necessary for the material to maintain the proper consistency during and after the cubing (densifying) process. The RSF and SPF was conveyed into a triple phase rotary dryer and the dried particles were then pulled into a cyclone which sent the particles into a 250 horse power cubing mill. The drying particles were then pressed into dyes and came out as 1 1/4 in by 3-4 in cubes. Approximately 18 tons of cubed alternative fuel was returned to the 784-A Powerhouse for the test burn. The cubed alternative fuel consisted of 65% RSF and 35% SPF. The Btu content of the alternative fuel was tested and was found to be in excess of 8,000 Btu/lb.

The second test started on May 6, 1997. Cubed RSF/SPF had been loaded into the 784-A1 fuel storage bunkers on the previous day. The fuel mixture started being feed onto the grate at approximately 1600 on May 6, 1997. From that point on until 1600, May 8, 1997 the unit fired the fuel mixture with no observed problems. As noted on the first test, flue gas temperatures declined and opacity also decreased. During the second test the ratio of cubes to coal was continually increased. Because of the amount of mixing which normally occurs in the fuel storage bunkers, it was impossible to exactly determine the amount of cubes to coal. For at least eight hours during the last stage of the test, the cubes to coal ratio was approximately 1 to 1 by volume. This was determined by taking a grab sample from the feed hopper above the feeders and manually separating the two materials after the test was complete. As in the first test, all of the observed effects resulting from the use of RSF/Coal as a fuel were either of no negative impact or some positive effect. In addition to lower opacity and flue gas exit temperatures, there was some indication of lower fuel demand for an equal steam flow. This is likely a result of the higher Btu density (Btu/lbm) of the cubed fuel. The higher Btu density is a result of the high Btu content of the SPF.

These two tests indicate there are no apparent technical problems associated with using cubed RSF/SPF as an alternative fuel for the SRS power boilers. This result is supported by test results from other industrial operations. 2

The successful test burns have led to the further development of a feasibility study and conceptual engineering plan for the establishment of a regional alternative fuel processing plant.

The initial tasks of identifying the potential partners and quantifying their respective wastestreams have been established. The equipment requirements to convert the wastestreams into alternative fuel are currently being established. A system layout for the alternative fuel plant will be developed following the determination of processing equipment. Siting criteria will then be established and potential sites will be identified. The environmental and permitting issues will be addressed as they apply to the operation of such a facility. The operating costs and financial impact of the alternative fuel plant will be established. An investment grade business plan will be developed and reviewed. The project team will identify financing for the project and determine the return on investment. A final report will be prepared and issued to DOE.

Conclusion

The partners believe one of the most important elements required for the success of the program is the development of a waste processing / alternative fuel facility by private industry. An alternative fuel processing facility will reduce the moisture content of the RSF and combine it with other fibrous waste streams (pallets, wood waste, and waste paper) in a densified form. The drying, size reduction and, consolidation of the RSF and other waste streams creates an economy of scale that can be offered to industry at a substantial savings compared to landfilling. The densified waste takes the form of a fuel cube suitable for burning as an alternative fuel in boilers. The utility departments for large industrial and governmental facilities combust coal in boilers to produce electricity and/or steam. The alternative fuel can be co-fired with coal or hog fuel to decrease the cost and dependency on fossil fuels. The alternative fuel will also be available to the powerhouses at a significant cost savings compared to coal. The reuse/recycling of wastestreams as an alternative fuel creates a win-win opportunity for industry and government.

The technology, wastestreams, and opportunity exist in the region surrounding SRS to create a positive solution for everyone. The successful development of an alternative fuel plant will rely on the joint cooperation of industry and government in committing their combined wastestreams to the project. This commitment to the growth of environmental stewardship will provide the economy of scale necessary for the establishment of a self-sustaining alternative fuel plant.

References

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