CO-COMBUSTION FEASIBILITY STUDY

Final Report

Prepared for

**THE NEW YORK STATE
ENERGY RESEARCH AND DEVELOPMENT AUTHORITY**

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**COTTRELL PAPER
TAGSONS PAPER
ENCORE PAPER
INTERNATIONAL PAPER
MOHAWK PAPER**

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An Energy Authority Report in Brief

Report: Co-Combustion Feasibility Study
Saratoga County Sewer District No. 1, Report 95-3

Project Manager: Lawrence J. Pakenas

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Background: This report describes the results of a study to determine the feasibility of co-combusting paper mill sludge and wastewater treatment plant sludge at the Saratoga County Sewer District's wastewater treatment plant. Paper mill sludge disposal has become an industry-wide problem in Saratoga County that must be solved if the paper companies are to continue operations in the area. Recognizing this need, the Saratoga County Sewer District invited County paper mills to join in a project to determine whether there were energy, economic, and environmental benefits in jointly constructing a co-combustion facility at the Sewer District's wastewater treatment plant. Five paper companies with mills in Saratoga County joined the Sewer District and the Saratoga County Industrial Development Agency in the study.

Objectives: The project had five objectives: to determine the quantity and quality of the sludges that would be delivered to the co-combustion facility; to evaluate the various options for co-combustion, including supplemental fuel, air pollution control, and residuals management; to calculate the amounts of energy products (e.g., steam and electricity) that could be produced from the heat of co-combustion and investigate options for energy use; to prepare a preliminary design of a co-combustion facility based on screening of options; and to determine an appropriate tipping fee that would be charged to disposal facility users.

R & D Results: The study showed that it would be technically feasible to construct and operate a co-combustion incinerator at the Saratoga County Sewer District. The economic feasibility of the project is based upon the tipping fee that the participants would be willing to pay for sludge disposal. The break-even tipping fee is approximately \$36 per dry ton of sludge disposed after all energy sales credits have been taken. Two of the participating paper companies stated that the tipping fee significantly exceeded their anticipated cost for sludge disposal and that they would probably not deliver their sludge to the co-combustion facility unless the tipping fee was reduced to \$20 per dry ton. The loss of sludge from these two mills would raise the tipping fee for the remaining companies and adversely affect the economic feasibility of the project.

Copies Available: A limited number of copies of the full report are available from Technical Communications, New York State Energy Research and Development Authority, 2 Empire State Plaza, Suite 1901, Albany, New York 12223-1253 or (518) 465-6251, ext. 272.

 

ABSTRACT

This report investigates the technical and economic feasibility of co-combusting municipal sewage sludge produced by the Saratoga County Sewer District No. 1 with paper mill sludge produced by the Cottrell Paper Company, Encore Paper Company, International Paper Company, Mohawk Paper Mills, and TAGSONS Papers at the Saratoga County Sewer District No. 1's secondary wastewater treatment plant and recovering any available energy products.

The co-combustion facility would consist of sludge and wood chip storage and conveying systems, belt filter presses, screw presses, fluidized-bed incinerators, venturi scrubbers and tray cooling systems, ash dewatering facilities, heat recovery steam generators, gas-fired steam superheaters, and a back-pressure steam turbine system. Clean waste wood chips would be used as an auxiliary fuel in the fluidized-bed incinerators. It is recommended that the ash produced by the proposed facility be beneficially used, potentially as a raw material in the manufacture of cement and/or as an interim barrier layer in landfills.

The steam produced by the heat recovery steam generators would be sold to TAGSONS Papers, Inc. The electricity produced would be used by the Sewer District. Based on preliminary cost estimates, it is estimated that the resulting sludge tipping fee would be approximately \$36.20 per dry ton of solids.

Based on the results of the study, it was determined that it would be technically feasible to co-combust municipal sewage sludge and paper mill sludge at the Saratoga County wastewater treatment plant. The economic feasibility of this project would be based on whether the estimated sludge tipping fee would be acceptable to each of the participants. Based on preliminary correspondence, three of the five participating paper companies have stated that the estimated sludge tipping fee would be acceptable.

Key words: co-combustion, paper mill sludge, municipal sewage sludge, heat recovery.

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ABBREVIATIONS

Btu	British thermal units
Cottrell	Cottrell Paper Company
CY	Cubic yard
EFC	New York State Environmental Facilities Corporation
Encore	Encore Paper Company
Energy Authority	New York State Energy Research and Development Authority
ft	Feet
gpd	Gallons per day
HRSG	Heat Recovery Steam Generator
hr	Hour
hp	Horsepower
in.	Inch
kg	Kilogram
kW	Kilowatt
kWh	Kilowatt hour
l	Liter
lb	Pound
IDA	Industrial Development Agency
IP	International Paper Company
IUP	Intended Use Plan
kv	Kilovolt
LS	Lump Sum
mBtu	Million British thermal units
mg	Milligram
mgd	Million gallons per day
Mohawk	Mohawk Paper Mills
MW	Megawatt
NA	Not Applicable
NIMO	Niagra Mohawk
NYSDEC	New York State Department of Environmental Conservation
NYSEG	New York State Electric & Gas Corporation
NYSPSC	New York State Public Service Commission
PIC	Products of incomplete combustion
PPL	State Project Priority List
psi	Pounds per square inch
PURPA	Public Utilities Regulatory Policy Act of 1978
rkvah	Reactive kilovolt ampere hour
SEDC	Saratoga Economic Development Corporation
SEQRA	State Environmental Quality Review Act
SERP	State Environmental Review Process
Sewer District	Saratoga County Sewer District No. 1
SPDES	State Pollutant Discharge Elimination System
SIU	Significant Industrial User
SRF	New York State Water Pollution Revolving Loan Fund
TAGSONS	TAGSONS Papers Inc.
TCLP	Toxicity characteristics leaching procedure
ug	Microgram
w	Width
VOC	Volatile organic compounds
v	Volt

SUMMARY

The Saratoga County Sewer District No. 1 owns and operates a conventional activated sludge wastewater treatment plant that is designed to provide secondary wastewater treatment for average flows of approximately 13 million gallons per day. The plant utilizes an existing fluidized-bed incinerator to combust municipal sewage solids and paper mill solids from TAGSONS Papers, Inc. Since the plant began operations in 1977, TAGSONS Papers, Inc. has been the largest permitted industrial user within the Sewer District. The Sewer District has identified the need to increase the treatment plant's solids handling capacity and/or restrict the discharge of solids by users in order to meet the Sewer District's existing and future needs.

Recognizing that paper mill sludge disposal is an industry-wide problem that must be solved if the paper industry is to continue to be a major part of Saratoga County's economic base, the Sewer District invited area paper industry representatives to a series of meetings in 1991 to determine if there was interest in the potential environmental and economic benefits that might result from the joint construction of a facility to co-combust municipal sewage sludge and paper mill sludge at the County wastewater treatment plant. As a result of these meetings, it was determined that there was interest in evaluating the feasibility of a joint project and this study was initiated.

The purpose of this project was to determine the technical and economic feasibility of co-combusting municipal sewage sludge produced by the Saratoga County Sewer District No. 1 with paper mill sludge produced by Cottrell Paper Company, Encore Paper Company, International Paper Company, Mohawk Paper Mills, and TAGSONS Papers at the County wastewater treatment plant. The recovery and use of available energy products from the co-combustion facility is an integral part of the economic analysis.

Based on correspondence with each participant, the co-combustion facility would be designed to co-combust approximately 153 dry tons of solids per day. The total solids content, total volatile solids content, total ash content, and heating values of each participant's sludge were determined based on a review of available sludge testing data and based on the results of a sampling and analysis program conducted as part of this study. The average total solids content of the sludge is approximately 30%. The average total volatile solids content of the sludge is approximately 62%. The average heating value of the sludge is approximately 4,150 British thermal units per pound of dry solids. In addition, sludge samples were

collected and analyzed for the toxicity characteristic leaching procedure parameters, heavy metals, and chloride content.

A review of the businesses and development in the vicinity of the County wastewater treatment plant has revealed that there are three potential customers for the energy products of a co-combustion facility. The potential customers are: the Saratoga County Sewer District No. 1, TAGSONS Papers, Inc., and the New York State Electric & Gas Corporation. The Saratoga County Sewer District No. 1 wastewater treatment plant's average monthly electric demand is approximately 2,233 kilowatts, and the average monthly electric usage is approximately 619,400 kilowatt-hours. The Sewer District's thermal energy needs are for space conditioning. TAGSONS Papers' average monthly electric demand is approximately 4,852 kilowatts, and the average monthly electric usage is approximately 2,643,500 kilowatt-hours. In addition, TAGSONS Papers has an average steam demand of approximately 32,500 pounds per hour for the pulping, steam valving, and heat tracing systems in the mill. The Public Utilities Regulatory Policy Act of 1978 requires public power utilities to purchase electrical power from qualifying small power generators. As a result, electrical energy produced by the County co-combustion facility could also be sold to the New York State Electric & Gas Corporation.

This report evaluates three types of incinerators for the co-combustion facility, including: rotary kiln incinerators, multiple-hearth incinerators, and fluidized-bed incinerators. Based on an evaluation and preliminary screening, two fluidized-bed incinerators are recommended. Fluidized-bed incinerators are recommended based on the Sewer District's 16 years of successful operation of a fluidized-bed incinerator to co-combust a mixture of municipal sewage sludge and paper mill sludge and based on the success of other fluidized-bed incinerators for combusting sewage sludge and/or paper mill sludge as identified in the literature research conducted as part of this study. In addition, it is believed that the fluidized-bed incinerator would have the lowest capital cost of the three types of incinerators evaluated.

The primary recoverable energy source of the co-combustion process would be the waste heat contained in the incinerator off-gas. This report considers several energy production options, including: the installation of heat recovery steam generators, an engine / generator set, and a gas turbine / generator set. Based on a review of these technologies, it is recommended that heat recovery steam generators be installed to produce steam for sale to TAGSONS Papers.

This report also evaluates the use of clean waste wood as a supplemental fuel in the fluidized-bed incinerators. Several waste wood processors were contacted to determine the availability of clean waste wood for this project. It was found that wood prices are variable and depend on the type of wood,

moisture content, competing end uses, and market conditions at the time of purchase. Based on a preliminary economic analysis, it was determined that if the Sewer District could purchase clean waste wood chips and/or pallets at a maximum cost of \$20 per ton, including delivery, then the use of waste wood would improve the economic feasibility of this project. Therefore, the use of clean waste wood as a supplemental fuel is included in the preliminary design. Contacts with waste wood vendors have revealed that clean waste wood could be secured at this maximum price.

Several residuals management options are investigated including: on-site disposal in an ash monofill; off-site disposal in an ash monofill; off-site disposal in a County or out-of-County landfill; and beneficial use options. It is recommended that beneficial use be the preferred ash disposal option. Based on a review of existing beneficial use determination permits issued by the New York State Department of Environmental Conservation, the two most probable beneficial uses for the ash produced by the co-combustion facility are as a raw material in the manufacture of cement and/or as an interim barrier layer in landfills.

The preliminary design of the co-combustion facility includes the relocation of the Sewer District's existing belt filter presses, and the installation of sludge and wood chip storage and conveying systems, two screw presses, two fluidized-bed incinerators, two heat recovery steam generators for the incinerator off-gas, venturi scrubbers and tray cooling systems, and on-site ash dewatering facilities. All of the steam produced by the heat recovery steam generators would be superheated, reduced through a back-pressure steam turbine, and then sold to TAGSONS Papers. A stand-by boiler would be installed to ensure that all of TAGSONS Papers' steam demands could be met. All of the electricity produced by the back-pressure steam turbine would be used by the Sewer District. This report presents preliminary construction cost estimates, annual operation and maintenance cost estimates, and annual energy revenue estimates for the proposed co-combustion facility.

An implementation plan describing the required regulatory permits and approvals, potential environmental impacts, financing options, required sludge tipping fees, and project schedule is presented. It is recommended that the project be financed using a low-interest rate loan from the New York State Revolving Fund program. A sensitivity analysis was conducted to evaluate the impact of changing the sludge tipping fee cost apportionment, sludge Btu values, and ash disposal costs on the resulting sludge tipping fee.

Based on the results of the study, it was determined that it would be technically feasible to co-combust municipal sewage sludge and paper mill sludge at the Saratoga County Sewer District No. 1's wastewater treatment plant. The economic feasibility of this project is based on the cost that each participant would

pay for sludge disposal at the proposed co-combustion facility. Based on each participant's proposed quantity of dry solids, the sludge tipping fee would be approximately \$36.20/dry ton. Correspondence with each of the participating paper companies indicates that this tipping fee would be acceptable to Cottrell Paper Company, Mohawk Paper Mills, and TAGSONS Papers. However, this tipping fee would not be acceptable to Encore Paper Company and International Paper Company. These two companies stated that they would pay a maximum sludge tipping fee of approximately \$20/dry ton and \$23/dry ton, respectively. Based on the sensitivity analysis, it is not likely that the sludge tipping fee could be reduced to \$20/dry ton. As Encore Paper Company and the International Paper Company would be contributing the largest quantities of sludge, if these companies decided not to proceed with the project, then the sludge tipping fees would increase and the project's economic viability would be reduced.

Section 1

INTRODUCTION

BACKGROUND

The Saratoga County Sewer District No. 1 (Sewer District) was established in 1971, in accordance with the provisions of Article 5A of County Law. The Sewer District serves residential, commercial, and industrial users within a 186-square-mile service area, which encompasses all or portions of the following communities:

• Town of Halfmoon	• Town of Malta
• City of Mechanicville	• Village of Round Lake
• Town of Clifton Park	• Town of Ballston
• Town of Saratoga	• Town of Greenfield
• City of Saratoga Springs	• Town of Wilton
• Village of Ballston Spa	• Town of Milton
• Town of Stillwater	

Figure 1-1 is a location map showing the service area of the Sewer District. Wastewater generated within the Sewer District is conveyed by an interceptor sewer system, consisting of approximately 40 pump stations and over 50 miles of interceptor sewer, to a wastewater treatment plant in Halfmoon, New York. The plant was constructed in 1977, and was designed to provide secondary wastewater treatment for average wastewater flows of approximately 13 million gallons per day (mgd).

The wastewater processing operations and facilities at the Saratoga County wastewater treatment plant include coarse screening, grit removal chambers, raw wastewater pumping, primary settling tanks, activated sludge treatment employing mechanical aeration, and secondary settling tanks. The effluent from the wastewater treatment plant is discharged to the Hudson River. Sludge handling equipment at the plant includes dissolved air flotation thickeners, sludge storage tanks, belt filter presses, and a fluidized-bed incinerator. Incinerator ash is stored in on-site lagoons.

Since 1977, TAGSONS Papers, Inc. (TAGSONS) has been the largest permitted industrial user within the Sewer District. TAGSONS manufactures kraft, natural, and bleached roll towelling from recycled paper.

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FIGURE NO. 1-1

SERVICE AREA OF THE SARATOGA COUNTY SEWER DISTRICT NO. 1

The mill is located in Mechanicville, approximately 1/2 mile northeast of the Saratoga County wastewater treatment plant, and discharges approximately 1 million gallons of wastewater, containing 10 to 15 dry tons of solids, to the sewer on a daily basis. The solids are removed in the plant's primary settling tanks, dewatered, and incinerated in the fluidized-bed incinerator with the plant's biological solids. While TAGSONS' solids have a high energy value and enhance the combustion process in the Sewer District's incinerator, the quantity of solids now being discharged by TAGSONS exceeds the limits allowed in their Significant Industrial User (SIU) permit. The Sewer District, in turn, is now handling solids beyond the capacity of its facilities and this has resulted in operational problems at the treatment plant. Because of this, the Sewer District has been forced to consider the expulsion of TAGSONS or an expansion of its current solids handling facilities.

The problems that are facing TAGSONS and the Sewer District are not unique. Few of the paper companies in the Saratoga County region have a long-range plan for the disposal of solids from their operations. Available solutions, such as incineration or landfilling are costly and difficult to implement, and many of the companies may be forced to close if an economical solution for solids disposal cannot be found.

Recognizing that paper sludge disposal is an industry-wide problem that must be solved if the paper industry is to continue to be a major part of Saratoga County's economic base, the Sewer District invited area paper industry representatives to a series of meetings at the County treatment plant to determine if there was interest in the potential environmental and economic benefits that might result from the joint construction of a facility to co-combust paper mill sludge and sewage sludge at the County wastewater treatment plant. Representatives from the following paper mills met with the Sewer District:

- Cottrell Paper Company, Inc.
- Encore Paper Company, Inc. (formerly James River)
- Finch Pruyn
- International Paper Company
- Katzenbach & Warren
- Mohawk Paper Mills, Inc.
- Scott Paper Company
- Stevens & Thompson Paper Company

- TAGSONS Papers, Inc.

As a result of the meetings, the following paper companies (the participating paper companies) decided to proceed forward with this feasibility study:

- Cottrell Paper Company, Inc.
- Encore Paper Company, Inc.
- International Paper Company
- Mohawk Paper Mills, Inc.
- TAGSONS Papers, Inc.

It is believed that other paper companies did not participate in this study because they had alternate sludge disposal plans that they were pursuing. Each of the participating paper companies has contributed funds toward the preparation of this study. Additional funding has been provided by the New York State Energy Research and Development Authority (the Energy Authority) and the Saratoga County Industrial Development Agency (IDA).

PURPOSE AND SCOPE

The purpose of this report is to determine the technical and economic feasibility of co-combusting municipal sewage sludge produced by the Saratoga County Sewer District No. 1 and paper mill sludge produced by Cottrell Paper Company, Encore Paper Company, International Paper Company, Mohawk Paper Mills, and TAGSONS Papers at the County wastewater treatment plant and recovering any available thermal energy produced by the facility.

The scope of work completed in preparing this report included the following:

- The projection of quantities and characteristics of sludge that would be received at the County sludge co-combustion facility, based upon a review of completed questionnaires from each participant, a review of all available sludge data, and the results of a sampling and analysis program
- An evaluation and screening of potential sludge processing and incineration technologies to determine the technology, or combination of technologies, that would best be suited for the sludge co-combustion facility; i.e., rotary kiln incineration; multiple-hearth incineration; fluidized-bed incineration; wood chip co-combustion; natural gas co-combustion; thermal drying systems; and dewatering systems

- An evaluation of the need and potential for using clean waste wood to offset changes in sludge quantities
- An evaluation and screening of potential energy recovery options, including: steam production, use, and recovery systems; and electrical generating systems
- An identification and evaluation of potential markets for the sale of energy products, including: the Sewer District; TAGSONS Papers; and the New York State Electric & Gas Corporation (NYSEG)
- An evaluation and screening of residuals management options
- The preliminary design of the selected sludge co-combustion facility, including: preparation of a one-line drawing showing the interrelationship of all principal components; sizing and selection of specific equipment, or general class of equipment; preparation of material and energy balances; and development of a preliminary facility site plan
- An evaluation of potential air emissions that would be generated by the proposed facility
- An evaluation of potential environmental externalities in accordance with the requirements of the Federal Clean Air Act
- The projection of revenue that would be generated from the sale of energy products
- The preparation of detailed construction cost estimates for the proposed sludge co-combustion facility
- The preparation of detailed operation and maintenance cost estimates for the proposed sludge co-combustion facility
- The identification and evaluation of potential funding options including: the County IDA; the Sewer District; private financing; the New York State Revolving Fund (SRF); and combinations of the above
- The determination of sludge tipping fees based on cost/benefit, considering such factors as sludge solids content, sludge fuel value, and ash content
- A sensitivity analysis to relate sludge tipping fees to sensitive project factors
- A description of permitting requirements and time tables, project planning and construction schedules, and other critical factors that could affect the project implementation.

Section 2

EXISTING CONDITIONS

This section describes each of the participating paper companies and their existing wastewater treatment and sludge management practices. This section also describes the existing operations and facilities at the County wastewater treatment plant. Figure 2-1 identifies the location of the five participating companies and the County wastewater treatment plant.

DESCRIPTION OF PARTICIPATING PAPER COMPANIES AND THEIR CURRENT SLUDGE MANAGEMENT PRACTICES

Cottrell Paper Company

Cottrell Paper Company, Inc. (Cottrell) is located in Rock City Falls, Saratoga County, New York. Cottrell produces brown kraft and bleached kraft, 100 percent cotton, class A electrical insulating paper. The mill's operating schedule is 24 hours/day, 5 days/week, and 48 weeks/year. The mill has a scheduled two-week shutdown every July, and is off-line 1 week during December and 1 other week during the year based on market conditions. Cottrell's average daily paper production is 6 tons/day, and maximum daily production is 9 tons/day.

Cottrell has an on-site wastewater treatment plant consisting of a collection sump, alum feed system, polymer feed system, flocculation tank, and settling tank. The average daily and maximum daily wastewater flow through the plant is 350,000 gallons per day (gpd) and 500,000 gpd, respectively. The effluent from the wastewater treatment plant is discharged to Kayaderosseras Creek.

Sludge handling facilities at Cottrell include a belt filter press. Sludge at approximately 3% solids is collected from the bottom of the settling tank and pumped to the belt filter press, which is typically operated 2 days/week. Cottrell's average daily and maximum daily sludge production from the belt filter press is 0.44 dry tons/day and 0.66 dry tons/day, respectively. Dewatered sludge, at approximately 22% solids, is trucked to the Wilmont Landfill in Cambridge, New York for final disposal.

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**CLOUGH, HARBOUR
& ASSOCIATES**
ENGINEERS, SURVEYORS, PLANNERS
& LANDSCAPE ARCHITECTS

III WINNERS CIRCLE - ALBANY, NEW YORK - 12205
P.O. BOX 5259 518-453-4500

FIGURE NO. 2-1

**LOCATION OF
PARTICIPANTS**

Encore Paper Company

Encore Paper Company, Inc. (Encore) is located in South Glens Falls, Saratoga County, New York. Encore is a secondary fiber mill that produces tissue and towelling. The mill's operating schedule is 24 hours/day, 7 days/week, and 52 weeks/year. Encore's average daily paper production is 130 tons/day, and maximum daily production is 160 tons/day.

Encore has an on-site wastewater treatment plant consisting of a primary clarifier, aeration tank, and two secondary clarifiers. The average daily and maximum daily wastewater flow through the plant is 2.25 mgd and 2.4 mgd, respectively. The effluent from the wastewater treatment plant is discharged to the Hudson River.

Sludge handling facilities at Encore include a sludge storage tank and two belt filter presses. Primary sludge is pumped to the storage tank, where it is mixed with process waste and secondary sludge and then pumped to a belt filter press, or it is pumped directly to the belt filter presses. Biological solids from the secondary clarifiers enter the storage tank and are then dewatered by a belt filter press. Encore's average daily and maximum daily sludge production is 65 dry tons/day and 85 dry tons/day, respectively. Dewatered sludge, at approximately 30% solids, is trucked to the Town of Moreau landfill for final disposal.

International Paper Company

International Paper Company (I.P.) is located in Corinth, Saratoga County, New York. I.P. produces wood-containing and free-sheet coated publication grades. The mill's operating schedule is 24 hours/day, 7 days/week, and 51 weeks/year. I.P.'s average daily paper production is 525 tons/day, and maximum daily production is 680 tons/day.

I.P. has an on-site wastewater treatment plant consisting of a bar screen, influent flume, two primary clarifiers, a high-rate trickling filter, and a secondary clarifier. The average daily and maximum daily wastewater flow through the plant is 10.5 mgd and 12.0 mgd, respectively. The effluent from the wastewater treatment plant is discharged to the Hudson River.

Sludge handling facilities at I.P. include two gravity thickeners, two vacuum filters, and one screw press. Primary and secondary sludge is pumped from the clarifiers to the gravity thickeners. The thickener effluent is pumped to the vacuum filters and then further dewatered using a screw press. I.P.'s average

daily and maximum daily sludge production is 90 tons/day and 120 tons/day, respectively. Most of I.P.'s sludge is disposed of in an on-site landfill. I.P. is permitted by the New York State Department of Environmental Conservation to beneficially use their sludge as a soil conditioner and as a raw material in the manufacture of pre-cast building and construction systems. In the past, I.P. has used its sludge as a cover material for the closure of the Town of Wilton and Town of Hadley landfills.

Mohawk Paper Mills

Mohawk Paper Mills, Inc. (Mohawk) is located in Waterford, Saratoga County, New York. Mohawk produces text and cover grade paper. The mill's operating schedule is 24 hours/day, 6 days/week, and 52 weeks/year. Mohawk's average daily paper production is 120 tons/day, and maximum daily production is 140 tons/day.

Mohawk has an on-site wastewater treatment plant consisting of rotating pre-stripping screens and a dissolved air flotation thickener. The average daily and maximum daily wastewater flow through the treatment plant is 1.3 mgd and 1.8 mgd, respectively. The effluent from the wastewater treatment plant is discharged to the Mohawk River.

Sludge handling facilities at Mohawk include a dissolved air flotation clarifier, a sludge holding tank, and a screw press. Sludge from the dissolved air flotation clarifier is stored in a holding tank and is then pumped from the tank to a screw press, which dewateres the sludge to approximately 43% solids. Mohawk's average daily and maximum daily sludge production is 1.6 dry tons/day and 3.1 dry tons/day, respectively. The dewatered sludge is currently being beneficially used as feedstock for the production of multi-ply paper board at another mill.

TAGSONS Papers

TAGSONS Papers, Inc. is located in Mechanicville, Saratoga County, New York. TAGSONS produces kraft, natural, and bleached roll towelling from recycled paper. The mill's typical operating schedule is 24 hours/day, 7 days/week, and 50 weeks/year. TAGSONS' average daily paper production is 144 tons/day, and maximum daily production is 200 tons/day.

TAGSONS does not have an on-site wastewater treatment plant. TAGSONS' wastewater undergoes coarse screening through a bar rack, and then it is discharged to the Sewer District's trunk sewer system. TAGSONS is planning to construct an on-site wastewater pretreatment plant that will include a dissolved

air flotation thickener. The sludge produced in the thickener will be pumped at approximately 3 to 4% solids to the solids handling processes at the County wastewater treatment plant, or it will be dewatered on-site using a belt filter press. TAGSONS' average daily and maximum daily sludge production is approximately 10 dry tons/day and 20 dry tons/day, respectively.

EXISTING SARATOGA COUNTY SEWER DISTRICT NO. 1 WASTEWATER TREATMENT PLANT

The County wastewater treatment plant is designed to provide secondary wastewater treatment for average wastewater flows of approximately 13 mgd. The existing average daily wastewater flow to the plant is approximately 10.6 mgd. The wastewater processing operations and facilities at the plant include coarse screening, grit removal chambers, raw wastewater pumping, primary settling tanks, conventional activated sludge treatment employing mechanical aerators, and secondary settling tanks. The effluent from the plant is discharged to the Hudson River.

Solids handling operations and facilities at the County wastewater treatment plant include dissolved air flotation thickeners to thicken the waste-activated sludge, sludge holding tanks to mix and store the primary and thickened waste-activated sludge, belt filter presses, a fluidized-bed incinerator, and ash lagoons. Mixed primary and thickened waste-activated sludge is pumped from the sludge holding tanks to one of two belt filter presses. The belt filter presses are each 1.5 meters in size, and were installed in 1982 to replace the vacuum filters that were furnished as original equipment with the plant construction. The dewatered sludge from the belt filter press is discharged to a hopper and pumped to the 19-foot diameter fluidized-bed incinerator. In 1992, the belt filter presses dewatered approximately 29.8 million gallons of sludge from approximately 5.25% solids to approximately 25% solids.

In 1992, the sludge processing facilities operated an average of 4 days/week. Typically, the sludge processing facilities are started-up on Sunday afternoon, and operate continuously until they are shut down on Thursday night. The operating duration is based on the capacity of the sludge holding tanks. The preheat time during startup is approximately 2 hours, and if the incinerator is shut down for less than 48 hours, then minimal preheating is required. In 1992, approximately 15,200 gallons and approximately 93,225 gallons of No. 2 fuel oil were used for preheating and burning, respectively. In 1992, the incinerator operated a total of approximately 5,200 hours and combusted approximately 6,570 dry tons of solids.

The existing fluidized-bed incinerator combusts autogenously at a sludge influent solids content of approximately 28%. The existing belt filter presses can dewater the sludge to this solids content; however, at a 28% solids content, the Sewer District has problems operating the incinerator feed pumps. For this reason, the belt filter press operation is limited to allow a maximum sludge total solids content of approximately 25% solids.

The combustion gases and ash exit the top of the fluidized-bed incinerator and pass through a heat exchanger, which preheats the air entering the incinerator. From the heat exchanger, the exhaust gases and ash pass through a venturi scrubber and cooling tower, where the gases and ash are cooled and separated. Wastewater effluent is used in the cooling tower and spent cooling water is returned to the head of the wastewater treatment plant. Ash slurry is pumped from the Solids Disposal Building to one of two ash lagoons. Decant from the ash lagoons is returned to the head of the wastewater treatment plant. Since startup of the treatment plant, all of the ash has been pumped to the two ash lagoons, with no ash removed from the lagoons. The existing ash lagoons are currently at full capacity and the Sewer District is investigating various final ash disposal options.

The existing fluidized-bed incinerator was not designed for significant thermal energy recovery. The only waste heat utilization is the heat exchanger used for preheating the air entering the incinerator. After 2 years of operation, the original heat exchanger was replaced with a new heat exchanger because of numerous operation and maintenance problems. The problems are believed to have been due to lime and ferric chloride buildup on the heat exchanger surface. These chemicals were originally used with the vacuum filters and their use was later discontinued when the belt filter presses were installed. Since this time, the Sewer District has not experienced any problems with the heat exchanger.

The existing fluidized-bed incineration system has operated satisfactorily to reduce the volume of sludge produced by the Sewer District. Based upon site visits and correspondence with the Sewer District, there are only a few deficiencies with the existing system. The major problem with the existing incineration system is that there is no redundancy. If the incinerator is taken off-line, there is no backup system available. Normal maintenance of the fluidized-bed incinerator is critical to the proper operation of the system. The time required to perform maintenance and repairs, including the time necessary to cool down and re-heat the incinerator, must be carefully planned to ensure that adequate sludge storage is available while the work is being performed. As the quantity of solids increases, and as the existing incineration system becomes older, the problems associated with the lack of a standby incineration system are expected to become more prevalent. In addition, it is expected that the annual cost of maintaining the existing

incineration system will increase as the system gets older. Over the past few years, the Sewer District has seen a steady increase in the annual cost to maintain and repair the incinerator.

Another problem with the County's existing solids handling system is that the two existing ash lagoons are at full capacity, and the Sewer District is now faced with the difficult task of finding an economically feasible ash disposal solution. With the closing of many of the landfills within Saratoga County, and the promulgation of new State solid waste regulations that regulate ash disposal, the Sewer District has had difficulties finding an acceptable ash disposal solution.

The problems that the Sewer District has experienced with the existing fluidized-bed incineration system are not due to the inability of the system to adequately process the municipal sewage sludge and paper mill sludge mixture, but are mainly due to the age and size of the existing system. In general, the Sewer District's fluidized-bed incinerator has operated well.

Section 3

WASTE SOURCES AND ALTERNATIVE FUELS

This section describes the various waste sources and alternative fuels considered in this study, including municipal sewage sludge, paper mill sludge, waste wood, natural gas, and No. 2 fuel oil.

SLUDGE

Municipal sewage sludge produced by the Saratoga County wastewater treatment plant and paper mill sludge produced by the five participating paper companies would be the largest waste source at the County sludge co-combustion facility. The projected quantities and characteristics of sludge that would be received by the facility are based on: the quantity of sludge that each participant indicated they would contribute in their original statement of interest form; responses to questionnaires sent to the participants; follow-up correspondence with each participant; a review of all available existing sludge data; and the results of actual sampling and analyses of the sludges.

Appendix A contains a copy of the statement of interest form completed by each paper company. On the statement of interest form, each participant indicated the average daily quantity of paper mill residues, on a dry weight basis, that they would want handled by a County sludge co-combustion facility. To further identify the quantities and characteristics of sludge produced by each of the participating paper companies, a questionnaire was developed and mailed to each company. Appendix B contains a copy of the completed questionnaire received from each company.

As a follow up to the statement of interest form, the questionnaire, and other correspondence, a letter was mailed to each participating paper company to confirm the quantity and total solids content of sludge that each company would want handled by the facility. Appendix C contains a copy of this follow up letter. In September 1993, a final questionnaire was sent to each of the participating paper companies to assess any changes in the proposed sludge quantities. Appendix D contains a copy of this questionnaire. Based on all of this information, and assuming that disposal costs and agreements would be acceptable to each participant, each of the participating paper companies indicated an interest in disposing of all or part of their sludge at a County-owned disposal facility. All of the Sewer District's existing and future wastewater sludge (based on a 100% capacity expansion to the existing wastewater treatment plant) would also be handled by the facility. Table 3-1 shows the projected existing and future sludge quantities and characteristics.

Table 3-1. Projected Sludge Quantities and Characteristics.						
PARTICIPANT	DRY SOLIDS QUANTITY (ton/day)	SLUDGE QUANTITY (ton/day)	SLUDGE PERCENT SOLIDS	SLUDGE PERCENT VOLATILE SOLIDS	SLUDGE PERCENT ASH CONTENT	SLUDGE BTU VALUE (Btu/lb dry solids)
Cottrell Paper Company	0.6	2.5	22	84	16	6,967
Encore Paper Company	75	250	30	63	37	3,567
International Paper Company	40	89	45	54	46	3,200
Mohawk Paper Mills	2	4.65	43	63	37	4,200
TAGSONS Papers & Saratoga County Sewer District No. 1						
Existing:	18	72	25	69	31	6,467
Future:	35	140	25	69	31	6,467
COMBINED-EXISTING	135.6	418.2	34	61	39	3,868.0
COMBINED-FUTURE	152.6	486.2	30	62	38	4,157.6

The average total solids content, total volatile solids content, and sludge British thermal unit (Btu) values shown in Table 3-1 were determined from available sludge data that was supplied by the participants and the results of the sampling and analysis program conducted as part of this study. Appendix E contains a copy of the sampling and analysis program and a summary of all of the sludge test results. In general, the total solids content and total volatile solids content results were consistent with previous sludge test results and did not significantly vary from test to test. Three Btu tests were performed on each participant's sludge. The sludge Btu values varied among participants and in many cases varied from test to test.

In addition to the sludge test results shown in Table 3-1, the results of toxicity characteristic leaching procedure (TCLP) tests on each participant's sludge were reviewed. Table 3-2 shows the TCLP test results.

Table 3--2. Summary of TCLP Test Results.

PARAMETER	COTTRELL PAPER COMPANY	ENCORE PAPER COMPANY	INTERNATIONAL PAPER COMPANY	MOHAWK PAPER MILLS	TAGSON'S PAPERS		SARATOGA COUNTY SEWER DISTRICT NO. 1
SLUDGE SAMPLING DATE	01/12/93	07/27/90	07/31/91	12/06/91	03/13/91	03/20/91	01/12/93
Arsenic	< 0.5 mg/l	< 0.05 mg/l	1.0 ug/l	0.001 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.5 mg/l
Barium	0.012 mg/l	0.7 mg/l	280 ug/l	0.9 mg/l	0.07 mg/l	0.01 mg/l	0.05 mg/l
Benzene	< 85 ug/l	< 5 ug/l	< 6.0 ug/l	0.001 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Cadmium	< 0.01 mg/l	< 0.01 mg/l	< 0.5 ug/l	0.02 mg/l	< 0.01 mg/l	< 0.01 mg/l	< 0.01 mg/l
Carbon Tetrachloride	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Chlordane	< 0.005 mg/l	< 0.02 mg/l	< 0.001 ug/l	< 0.0002 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Chlorobenzene	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Chloroform	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Chromium	< 0.05 mg/l	< 0.05 mg/l	30 ug/l	< 0.02 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.05 mg/l
o-Cresol			< 10 ug/l	< 0.02 mg/l			
m-Cresol			< 10 ug/l	< 0.02 mg/l			
p-Cresol			< 10 ug/l	< 0.02 mg/l			
Cresol	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
2,4-D	< 2 mg/l	< 2 mg/l	< 0.2 mg/l	< 0.2 mg/l	< 2 mg/l	< 2 mg/l	< 2 mg/l
1,4-Dichlorobenzene	< 100 ug/l	< 160 ug/l	< 0.1 ug/l	0.01 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
1,2-Dichloroethane	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
1,1-Dichloroethylene	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
2,4-Dinitrotoluene	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Endrin	< 0.005 mg/l	< 0.008 mg/l	< 0.0006 ug/l	< 0.02 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Heptachlor	< 0.005 mg/l	< 0.004 mg/l	< 0.0006 ug/l	< 0.0002 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Heptachlor Epoxide	< 0.005 mg/l	< 0.004 mg/l	< 0.0006 ug/l	0.001 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Hexachlorobenzene	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Hexachlorobutadiene	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Hexachloroethane	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Lead	< 0.5 mg/l	< 0.5 mg/l	19 ug/l	< 0.1 mg/l	< 0.5 mg/l	< 0.5 mg/l	< 0.5 mg/l
Lindane	< 0.005 mg/l	< 0.004 mg/l		< 0.0002 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Mercury	< 0.02 mg/l	< 0.05 mg/l	< 1.0 ug/l	< 0.001 mg/l	< 0.02 mg/l	< 0.02 mg/l	< 0.02 mg/l
Methoxychlor	< 0.05 mg/l	< 0.04 mg/l	< 0.5 ug/l	< 0.0002 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.05 mg/l
Methyl Ethyl Ketone	< 170 ug/l	< 10 ug/l	< 10 ug/l	< 0.001 mg/l	< 10 ug/l	< 10 ug/l	< 710 ug/l
Nitrobenzene	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Pentachlorophenol	< 500 ug/l	< 790 ug/l	< 50 ug/l	< 0.02 mg/l	< 500 ug/l	< 500 ug/l	< 500 ug/l
Pyridine	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Selenium	< 0.1 mg/l	< 0.05 mg/l	4.0 ug/l	< 0.002 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.1 mg/l
Silver	< 0.02 mg/l	< 0.02 mg/l	1.0 ug/l	0.03 mg/l	< 0.02 mg/l	< 0.02 mg/l	< 0.02 mg/l
Tetrachlorethylene	< 85 ug/l	< 5 ug/l	< 6.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Toxaphene	< 0.05 mg/l	< 0.08 mg/l	< 0.05 ug/l	< 0.001 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.05 mg/l
Trichlorethylene	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
2,4,5-Trichlorophenol	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
2,4,6-Trichlorophenol	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
2,4,5-TP (Silvex)	< 0.2 mg/l	< 0.2 mg/l	< 0.05 ug/l	< 0.02 mg/l	< 0.2 mg/l	< 0.2 mg/l	< 0.2 mg/l
Vinyl Chloride	< 170 ug/l	< 10 ug/l	< 10 ug/l	< 0.0005 mg/l	< 10 ug/l	< 10 ug/l	< 170 ug/l

Based on the TCLP test results shown in Table 3-2, all of the participant's sludge would be considered nonhazardous. In addition to the TCLP analyses, composite sludge samples from each participant were analyzed for New York State Department of Environmental Conservation (NYSDEC) Part 360-3.5D parameters and chloride content. Tables 3-3 and 3-4 show these test results.

Table 3-3. Summary of NYSDEC Part 360-3.5D Test Results for Ash Residue Metals.		
PARAMETER	SLUDGE ANALYSIS (mg/kg)	TCLP EXTRACT (mg/l)
Antimony	< 3	< 0.06
Arsenic	< 0.25	< 0.5
Beryllium	< 0.25	< 0.005
Barium	9.7	0.14
Cadmium	0.54	< 0.01
Chromium, Total	1.05	< 0.05
Chromium, Hexavalent	< 0.1	< 0.1
Copper	17.9	< 0.05
Lead	< 5	< 0.5
Mercury	< 0.02	< 0.02
Nickel	< 2.5	< 0.05
Selenium	0.25	< 0.1
Silver	< 1	< 0.02
Thallium	< 0.5	< 0.025
Zinc	33.0	< 0.09
Calcium	14,800	450
Iron	164	< 0.01
Silicon	122	2.05
Tin	1.8	< 0.05
Aluminum	1,080	0.54
Chloride	120	18
Sulfate	78	3

Table 3-4. Summary of Chloride Test Results.		
Participant	Sample Date	Chloride (mg/kg)
Cottrell Paper Company	10/11/93	< 59,000
Encore Paper Company	10/06/93	1,200
International Paper Company	10/14/93	< 100
Mohawk Paper Mills	10/11/93	< 240
TAGSONS Papers & Saratoga County Sewer District No. 1	10/20/93	4,700

The TCLP of the composite sludge sample demonstrated low levels, if any, of the ash residue metals. In addition, the TCLP extract metal results were compared to groundwater and drinking water standards. All reported levels were well below the applicable regulatory limits. Few regulatory limits exist for naturally derived constituents of paper mill sludge. However, based on comparisons with previous sludge studies, the results reported for the composite sludge sample are within typical ranges. In addition, the levels detected are comparable to typical natural elemental background levels for regional soils. Based on the chloride test results in Table 3-4, the chloride content of the sludge samples varied among participants. The test results shown in Table 3-4 are the reliable reporting limits for the test procedure. The less-than sign (<) on three of the results indicates that the chloride content is below the reported limit. The reliable reporting limit varies due to interference within the sludge samples. If the results of this study show that this project is feasible and each of the participants decide to proceed with this project, then additional testing would be recommended to further characterize the chloride content of the participant's sludges and to identify all of the impacts of the sludges' chloride content on incinerator operations.

WASTE WOOD

A sizeable portion of New York State's solid waste stream is wood that represents a growing disposal problem. Using clean waste wood as a fuel provides new opportunities for a solid waste problem to become a renewable energy solution. Clean waste wood, such as used pallets, are a good fuel source since they are free of the chemical contaminants found in some types of treated wood and have a low moisture content. Wood waste processors typically charge a tipping fee for materials dropped off at their site; they then sort out and process the clean wood fraction, and sell the clean wood waste as fuel.

To determine the availability of clean waste wood for this project, several processors were contacted to determine the available quantity, characteristics, and cost. Table 3-5 shows a summary of the results of the investigation.

Based on the investigation, it was determined that wood fuel prices are variable and depend on the type of wood, moisture content, competing end uses, and market conditions at the time of purchase. Based on the "Waste Wood Resource Supply Assessment", Final Report prepared by C.T. Donovan Associates for the Energy Authority (Report 91-6, Energy Authority project number 1416-ER-IHR-90, dated August 1991), the price charged by waste wood processors in New York State and the Northeast for processed wood waste for fuel in 1989 was \$7.50 to \$16.00 per ton, not including trucking, and \$16.00 to \$28.00 per ton, including trucking; the moisture content ranges from 7% to 20%. For the purposes of this report,

Table 3-5. Summary of Investigation of Clean Waste Wood Sources.

COMPANY	LOCATION	RESPONSE	SITE DELIVERY COST	PURCHASE COST	TOTAL COST (DELIVERY + PURCHASE)
ADIRONDACK FOREST INDUSTRIES	GALWAY, NY	20 CUBIC YARDS / DAY AVAILABLE	CONTRACT SPECIFIC	\$15 TO \$16/TON	CURRENTLY SELL TO INTERNATIONAL PAPER FOR \$24 / TON WITH DELIVERY
BFI WASTE SYSTEMS	LATHAM, NY	NONE AVAILABLE	-	-	-
BQE SERVICES	BROOKLYN, NY	1,200 CUBIC YARDS / DAY AVAILABLE	\$300 / TRUCK LOAD TRUCK LOAD = 120 CUBIC YARDS	\$0	\$2.50 / CUBIC YARD
CAPITAL DISTRICT BY-PRODUCTS, INC.	SCHENECTADY, NY	NONE AVAILABLE	-	-	-
CAPITAL WOOD RECYCLING	ALBANY, NY	NONE AVAILABLE	-	-	-
CODDINGTON LUMBER	FULTONVILLE, NY	50 TONS / WEEK AVAILABLE	WILL NOT DELIVER	\$7.50 / CUBIC YARD	\$7.50 / CUBIC YARD + DELIVERY
INTERNATIONAL PAPER COMPANY	CORINTH, NY	WOOD AVAILABLE FROM THEIR WOOD HARVEST; WOOD WOULD BE CHIPPED BY OTHERS	WILL NOT DELIVER	\$17 TO \$23 / TON	\$17 TO \$23 / TON + DELIVERY
KILMER LUMBER CO., INC.	MIDDLEGROVE, NY	50 TONS / WEEK AVAILABLE	WILL NOT DELIVER	\$22 / TON	\$22 / TON + DELIVERY
L. J. VALENTE, INC.	AVERILL PARK, NY	50 TONS / WEEK AVAILABLE	\$100 / TRUCK (< 100 MILES) TRUCK LOAD = 30 TO 50 CUBIC YARDS	\$6 / CUBIC YARD	
NORTH AMERICAN RECYCLING CORP.	ALBANY, NY	NONE AVAILABLE	-	-	-
RECYCLE WOOD PRODUCTS	BOSTON, MA	CURRENTLY HAS TOO MANY CONTRACTS, BUT 500 CUBIC YARDS / DAY AVAILABLE	\$4 / CUBIC YARD TRUCK LOAD = 120 CUBIC YARDS	\$8 / CUBIC YARD	\$12 / CUBIC YARD
SARATOGA FOREST PRODUCTS	WILTON, NY	100 TONS / DAY AVAILABLE (50 - 60% MOISTURE)	DO NOT DELIVER	CONTRACT SPECIFIC	CURRENTLY SELL TO INTERNATIONAL PAPER FOR \$25 / TON WITHOUT DELIVERY
UNION TOOLS	FRANKFORT, NY	PRODUCE 2,000 TO 5,000 CUBIC FEET / DAY WOOD CHIPS PRODUCED ARE CONSUMED LOCALLY NO WOOD CHIPS AVAILABLE FOR THIS PROJECT	-	-	-

NOTE: Based on conversations with suppliers, there are approximately 5 cubic yards per ton of wood chips.

it has been assumed that clean waste wood would be available at \$20.00 per ton including trucking, and the average moisture content would be approximately 15%.

NATURAL GAS

Natural gas is available in the vicinity of the County wastewater treatment plant. Niagara Mohawk Power Corporation has a 10-inch-diameter low-pressure gas main located along NYS Route 4. Gas is available at pressures of approximately 25 pounds per square inch (psi) in the winter and 22 psi in the summer. The County wastewater treatment plant currently does not use natural gas.

NO. 2 FUEL OIL

The County wastewater treatment plant currently uses No. 2 fuel oil in its hot water boilers and fluidized-bed incinerator. No. 2 fuel oil is readily available in the area at a cost of approximately \$0.85/gallon.

Section 4

EVALUATION OF POTENTIAL MARKETS FOR THE SALE OF ENERGY PRODUCTS

Identifying a firm and stable market for the sale of the energy products of combustion, such as steam and electricity, will be a key factor in determining the economic viability of a County co-combustion facility. Ideally, customers for the energy products should be located close to the proposed facility to reduce transmission losses and expenses, but the cost they are willing to pay for the energy products should be competitive with rates for the products elsewhere in the marketplace.

A review of the businesses and development in the vicinity of the County wastewater treatment plant indicates that there are three existing potential customers for the energy products of the co-combustion facility. These are:

- The Saratoga County Sewer District No. 1 (steam and electricity)
- TAGSONS Papers, Inc. (steam and electricity)
- New York State Electric & Gas Corporation (electricity).

In addition to these existing potential customers, the Saratoga County Industrial Development Agency and the Saratoga Economic Development Corporation (SEDC) both believe that the availability of low cost energy products could attract new industry to the vacant commercial and industrial properties that are adjacent to the County treatment plant.

In this section of the report, the energy requirements and potential purchase sale agreements for the sale of the energy products from the County co-combustion facility are evaluated.

SARATOGA COUNTY SEWER DISTRICT NO. 1

The Sewer District is a logical first customer to purchase the energy products of the co-combustion facility. The Sewer District has expressed a willingness to become a system customer and has needs for electricity and, to a lesser degree, heat. The Sewer District has indicated that they would purchase these products if they could be produced at rates that are competitive with existing sources.

The electrical energy requirements of the Sewer District are currently satisfied by NYSEG. NYSEG provides service to the Sewer District directly off its primary power grid at a voltage of 34.5 kilovolts (kv). The voltage of the incoming power is reduced by primary power transformers owned by the Sewer District

to a voltage of 4160 volts (v). After the power has been reduced to 4160v, it is distributed within the plant. Various subtransformers located throughout the plant are then used to step down the power to voltages ranging from 240v to 460v.

The electrical needs of the Sewer District are created by the motors used to drive process equipment, and by needs for general lighting and heating. Table 4-1 is a summary of the existing major connected electrical loads at the treatment plant. Since the County treatment plant operates continuously 24 hours/day, 365 days/year, the daily electrical requirements at the plant are fairly uniform from day-to-day. The highest electrical demands occur on days when the sludge incinerator is in operation since the incinerator requires the operation of the belt filter press, the dewatered sludge pumps, the fluidizing-air blower, and the ash slurry pump.

A summary of the monthly electric demand, usage, and electrical energy costs for the Sewer District is presented in Table 4-2. During the period of analysis presented in this summary (January 14, 1992 - December 10, 1992), the average monthly electric demand by the Sewer District was approximately 2,233 kilowatts (kW) and the average monthly electric usage was approximately 619,400 kilowatt-hours (kWh). The average monthly cost of electricity during this period was approximately \$42,554.

NYSEG's charges to the Sewer District for electrical energy are determined by the rate schedules adopted by NYSEG with the approval of the New York State Public Service Commission (NYSPSC). Under the current rate schedule, the Sewer District is classified as a non-residential rate user. Current rates for service under this classification include an on-peak service charge of approximately \$0.065/kWh and an off-peak service charge of approximately \$0.045 kWh. The demand charge is presently \$6.95/kW and the reactive kilovolt ampere hour (rkvah) charge is \$0.0006/rkvah.

In addition to electrical energy needs, the Sewer District also has thermal energy needs for space conditioning. These demands are currently met using oil-fired boilers to operate hot water heating systems. The demand for heat is largely seasonal with the highest needs occurring between October and March. A summary of these requirements, including monthly oil usage and costs, is presented in Table 4-3.

Table 4-1. Major Electrical Equipment Loads at the Sewer District.			
ITEM	NUMBER OF UNITS AND HP/UNIT	TOTAL HP	TYPE OF OPERATION
Raw Sewage Pump Station Raw Sewage Pump	4 @ 100 hp	400 hp	Intermittent
Grit Chamber Aeration Blowers Grit Pumps	4 @ 5 hp 4 @ 15 hp	20 hp 60 hp	Continuous Continuous
Primary Settling Tanks Clarifier Drives Primary Sludge Pumps Reaeration Blowers	3 @ 3/4 hp 3 @ 15 hp 2 @ 15 hp	2-1/4 hp 45 hp 30 hp	Continuous Intermittent Continuous
Aeration Basins Mechanical Aerators	12 @ 60 hp	720 hp	Continuous
Final Settling Tanks Clarifier Drives Return Activated Sludge Pumps Waste Activated Sludge Pumps	3 @ 3/4 hp 3 @ 60 hp 2 @ 25 hp	2-1/4 hp 180 hp 50 hp	Continuous Continuous Intermittent
Sludge Dewatering/Storage Dissolved Air Flotation Thickeners Belt Filter Presses Sludge Transfer Pumps Sludge Mixers	2 @ 45 hp 2 @ 30 hp 3 @ 30 hp 3 @ 50 hp	90 hp 60 hp 90 hp 150 hp	Intermittent Intermittent Intermittent Continuous
Fluidized-Bed Incineration System Sludge Feed Pumps Fluidizing-Air Blower Preheat Burner Blower Ash Slurry Pumps	2 @ 60 hp 1 @ 300 hp 1 @ 60 hp 2 @ 30 hp	120 hp 300 hp 60 hp 60 hp	Intermittent Intermittent Intermittent Intermittent
Building and Outside Lighting	50 hp	50 hp	Intermittent
HVAC Fans and Motors	300 hp	300 hp	Intermittent
High-Pressure Water Pumps	3 @ 60 hp 2 @ 20 hp	180 hp 40 hp	Intermittent Intermittent
Low-Pressure Water Pumps	3 @ 20 hp	60 hp	Intermittent

Table 4-2. Summary of Sewer District 1992 Electric Usage, Demand, and Cost.				
BILLING PERIOD	DEMAND (kw)	ELECTRICITY USED (kwh)	RKVAH	TOTAL COST
01/14/92-02/12/92	2,283.7	619,500	569,625	\$40,411.62
02/12/92-03/13/92	2,336.2	643,125	590,625	43,540.28
03/13/92-4/13/92	2,257.4	630,000	593,250	42,164.26
04/13/92-05/13/92	2,309.9	632,625	595,875	43,745.87
05/13/92-06/12/92	2,231.2	619,500	609,000	43,138.25
06/12/92-07/14/92	2,362.4	666,750	661,500	45,540.66
07/14/92-08/12/92	2,231.2	572,250	580,125	38,851.92
08/12/92-09/11/92	2,099.9	595,875	611,625	40,664.55
09/11/92-10/12/92	2,126.2	624,750	627,375	42,835.26
10/12/92-11/09/92	2,073.7	547,500	561,750	40,951.51
11/09/92-12/10/92	2,257.5	661,500	632,625	46,245.88
			TOTAL	\$468,090.06
			AVERAGE	\$42,553.64

TAGSONS PAPERS, INC

TAGSONS Papers, Inc. represents the largest potential energy customer of the County co-combustion facility. As a participant in this study, TAGSONS has expressed an interest in purchasing both electricity and steam from the County, provided that these energy products can be provided, with a high degree of reliability, at rates at or below the rates now paid by TAGSONS to their current energy suppliers.

TAGSONS, like the Sewer District, currently receives its electrical power from NYSEG. NYSEG provides service to TAGSONS off its primary power grid at a voltage of 34.5kv. The voltage is then stepped down to 4160v by two primary power transformers owned by TAGSONS, which have a combined rating of 8750 kva. Once the power has been reduced to 4160v, it is distributed to subtransformers throughout the mill, which step it down further to operating voltages. The subtransformers provide power to the operating equipment at voltages varying from 120v to 4160v.

Table 4-3. Summary of Sewer District 1992 No. 2 Fuel Oil Usage and Costs.

MONTH	INCINERATION BURN		INCINERATOR AIR PRE-HEAT		TREATMENT PLANT BOILERS	
	OIL USED (gallons)	COST	OIL USED (gallons)	COST	OIL USED (gallons)	COST
January	7,465	\$4,243.69	1,515	\$861.61	15,515	\$8,936.64
February	9,954	6,091.69	987	600.96	12,321	7,491.17
March	8,117	\$4,758.55	1,080	630.62	12,274	7,180.29
April	12,373	7,515.36	1,240	753.18	8,303	5,039.92
May	9,359	6,069.88	861	556.86	3,915	2,529.09
June	14,277	9,544.18	1,127	755.58	4,041	2,711.51
July	7,740	5,298.19	1,008	686.10	2,319	1,576.92
August	4,288	2,835.00	974	640.97	2,142	1,413.72
September	4,677	3,139.76	1,46	N/A	3,943	2,645.75
October	4,080	2,843.35	1,767	1,231.42	8,539	5,951.68
November	6,720	1,521.46	2,384	1,604.62	10,751	7,213.92
December	9,175	6,385.80	1,110	772.56	10,972	7,636.51
TOTAL	98,225	\$60,296.91	15,499	\$10,128.49	95,035	\$60,327.12
AVERAGE	8,185	\$5,024.74	1,292	\$844.04	7,920	\$5,027.26

The electrical needs of TAGSONS are created by the motors used to drive mill machinery and equipment, and by needs for general lighting and heating. Table 4-4 is a summary of TAGSONS' major connected electrical equipment loads.

TABLE 4-4. Summary of TAGSONS' Major Electrical Equipment Loads		
HP RANGE	QUANTITY	TOTAL CONNECTED HP
1/3 to 1	7	19
2 to 5	33	129
10 to 20	14	260
25 to 30	8	215
40 to 50	29	1,290
60 to 100	11	985
125 to 200	15	2,450
250 to 300	6	1,650
325 to 350	3	1,025
600	1	600
800	1	800
TOTAL	138	9,423

The patterns of electrical use at TAGSONS are directly influenced by mill operations. Under ideal conditions, the mill operates continuously 24 hours/day, 365 days/year, with fairly uniform daily power demands. However, weak demand for paper and/or the need to perform equipment maintenance can force TAGSONS to shutdown for periods of up to 1 week, during which time the electrical demands are very low. This potential for wide fluctuations in electrical power usage would make it difficult for the County to install electrical generating equipment sufficient to meet TAGSONS' total needs.

A summary of the monthly electrical usage and electrical energy costs for TAGSONS is provided in tables 4-5 and 4-6. During the period of analysis presented in this summary (December 12, 1991 to December

Table 4-5. Summary of TAGSONS Papers, Inc. 1992 Electric Demand, Usage, and Reactive Metering.

BILLING PERIOD	DAYS/ BILLING PERIOD	NUMBER OF DAYS MILL DOWN	ON-PEAK SERVICE			OFF-PEAK SERVICE
			DEMAND (kw)	ELECTRICITY USED (kwh)	RKVAH	ELECTRICITY USED (kwh)
12/12/91-01/14/92	33	5	4,770.0	1,071,000	1,477,000	1,779,000
01/14/92-02/12/92	29	2	4,890.0	1,323,000	1,414,000	1,428,000
02/12/92-03/13/92	30	10	4,860.0	1,113,000	1,122,000	975,000
03/13/92-04/13/92	31	19	4,800.0	699,000	735,000	543,000
04/13/92-05/13/92	30	2	4,950.0	1,320,000	1,456,000	1,395,000
05/13/92-06/12/92	30	3	4,800.0	1,248,000	1,458,000	1,416,000
06/12/92-07/14/92	32	2	4,800.0	1,281,000	1,571,000	1,602,000
07/14/92-08/12/92	29	0	4,800.0	1,281,000	1,571,000	1,602,000
08/12/92-09/11/92	30	1	4,890.0	1,284,000	1,520,000	1,518,000
09/11/92-10/12/92	31	0	4,890.0	1,206,000	1,620,000	1,791,000
10/12/92-11/09/92	28	0	4,860.0	1,281,000	1,522,000	1,614,000
11/09/92-12/10/92	31	0	4,920.0	1,317,000	1,581,000	1,635,000

Table 4-6. Summary of TAGSONS Papers, Inc. 1992 Electric Costs.

BILLING PERIOD	DAYS/ BILLING PERIOD	NUMBER OF DAYS MILL DOWN	ON-PEAK SERVICE COST			OFF-PEAK SERVICE COST	OTHER COSTS ¹	TOTAL COSTS
			DEMAND	ELECTRICITY USED	RKVAH	ELECTRICITY USED		
12/12/91-01/14/92	33	5	\$33,151.97	\$69,382.59	\$933.46	\$79,261.56	(\$18,287.13)	\$164,442.45
01/14/92-02/12/92	29	2	33,985.98	85,707.90	893.64	63,623.11	(12,737.19)	171,473.44
02/12/92-03/13/92	30	10	33,777.48	72,103.47	709.10	43,440.15	556.00	150,586.20
03/13/92-04/13/92	31	19	33,359.52	45,282.61	464.52	24,192.27	218.22	103,517.14
04/13/92-05/13/92	30	2	34,402.00	85,512.24	920.19	62,151.43	(3,159.46)	179,826.40
05/13/92-06/12/92	30	3	33,359.52	81,203.61	925.83	63,364.58	29.59	179,030.01
06/12/92-07/14/92	32	2	33,506.40	86,669.24	1,053.46	74,507.08	(3,929.26)	191,806.92
07/14/92-08/12/92	29	0	35,841.60	86,575.10	1,162.54	74,398.48	(17,801.37)	180,176.35
08/12/92-09/11/92	30	1	36,513.63	86,777.85	1,124.80	70,497.43	(13,710.03)	181,203.68
09/11/92-10/12/92	31	0	36,513.63	81,506.30	1,198.80	83,175.83	(10,394.62)	191,999.94
10/12/92-11/09/92	28	0	36,164.71	86,276.63	1,123.23	74,699.14	(4,632.18)	193,631.53
11/09/92-12/10/92	31	0	36,611.19	88,701.26	1,166.77	75,671.07	(2,978.15)	199,172.14
TOTAL	364	44	\$417,334.51	\$955,698.80	\$11,676.34	\$788,982.13	(\$86,825.58)	\$2,086,866.20
AVERAGE	30	4	\$34,777.87	\$79,641.57	\$973.03	\$65,748.51	(\$7,235.46)	\$173,905.52

⁽¹⁾Economic development incentives, fuel adjustments, and basic service charge

10, 1992), the average monthly electrical demand by TAGSONS was 4,852 kW and the monthly electric usage was 2,643,500 kWh. The average monthly charge for electricity used by TAGSONS during this period was approximately \$173,900/month.

NYSEG's charges to TAGSONS for electrical energy are determined by the rate schedules adopted by NYSEG with the approval of the NYSPSC. Under the current rate schedule, TAGSONS is classified as a non-residential customer (rate 1150730). Current rates for service under this classification include an on-peak service charge of approximately \$0.065/kWh and an off-peak service charge of approximately \$0.045/kWh, although TAGSONS receives an economic development incentive adjustment that effectively reduces these rates by about 5%. The current demand charge is \$6.95/kW and the rkvh charge is \$0.0006/rkvah.

In addition to requiring large amounts of electricity, TAGSONS uses large quantities of gas and oil to produce steam for pulping operations and hot air for drying the finished paper sheet. The steam used by TAGSONS is produced by an on-site steam boiler with a maximum capacity rating of 68,600 Btu/hour of saturated steam at a pressure of 100 psi. The steam boiler has dual-fuel capabilities and is run on natural gas or No. 2 fuel oil, depending upon market prices for these products. When the mill is in operation, steam demands average 32,500 lb/hr and the steam is distributed approximately as follows:

- 80% for pulping
- 20% for steam valves and heat tracing systems.

Boiler makeup water requirements for the steam system are high because there is no condensate return system at the mill. In 1992, boiler makeup water averaged 100,000 gpd. Water is supplied to TAGSONS by the City of Mechanicville at a cost of \$1.52/1,000 gallons and undergoes further treatment at TAGSONS before it is delivered to the boiler system.

Up until 1990, TAGSONS used steam dryers to dry the finished sheet off the paper machine. The system was replaced in late 1990 with a new gas-fired air cap that uses natural gas to produce high temperature hot air to dry the paper. The air cap has a rating of 30 mBtu/hr, although it actually runs at approximately 50% of its rated capacity.

Monthly gas and oil usage by TAGSONS during 1991 is presented in Table 4-7.

Table 4-7. Summary of TAGSONS Papers, Inc. 1992 Gas and Oil Usage.		
MONTH	OIL USAGE (gallons)	GAS USAGE (decatherms)
January	0	38,496
February	0	32,031
March	0	12,092
April	0	20,469
May	0	28,907
June	0	31,082
July	0	33,377
August	0	35,847
September	0	34,880
October	6,960	14,939
November	0	37,500
December	0	42,176
TOTAL	6,960	361,796

Based upon the period of analysis covered in this report, TAGSONS average daily gas usage for heating and drying operations is approximately 67 decatherms/hr when the mill is in operation. The energy cost of these operations on an annual basis is approximately \$2,000,000.

NEW YORK STATE ELECTRIC & GAS CORPORATION

The Public Utilities Regulatory Policy Act of 1978 (PURPA) requires public power utilities to purchase electrical power from qualifying small power generators. As a result of this act, electrical energy produced by the County co-combustion facility could be sold to NYSEG.

The rate NYSEG is required to pay the County is established by the NYSPSC based upon the avoided cost of electrical production for NYSEG. This rate is currently \$0.035/kWh, but it will vary from year to year as a result of inflation, fuel adjustment factors, etc. To sell power to NYSEG, the County would need to comply with all of the requirements for parallel power generation that are established by NYSEG. The requirements of small generators (<10MW) are covered in NYSEG Technical Bulletin No. 42 and generally will require:

- Installing and maintaining approved metering devices
- Installing protective equipment and circuits to prevent the accidental backfeeding of NYSEG's grid during maintenance or repair periods
- Using synchronous generators with phase adjustment capacitors.

These requirements would apply only for the outside sale of power to NYSEG. If power production is used entirely by the County co-combustion facility, then the requirements for power generation would be less. The power must, however, be used on-site or the County would be subject to the requirements for a utility.

OTHER POTENTIAL MARKETS

The only unidentified market from the sale of energy products from the proposed County co-combustion facility would be future business or industry that could be attracted to the area based upon the availability of public utilities (sewer and water) and a guaranteed source of economical electricity or steam. Although the SEDC has had a number of inquiries by business owners about the properties that adjoin the Sewer District, and it is likely that the adjoining properties will be developed in the future, there are no certain markets for energy products for the adjoining lands. This may change in time and this factor may have a bearing on the development of the co-combustion facility.

CONTRACTUAL AND LEGAL REQUIREMENTS FOR PURCHASE SALE AGREEMENTS

Assuming that the County is able to develop a co-combustion facility that produces energy products for sale to potential steam and electric customers, purchase/sale agreements would need to be developed with each prospective customer. While the exact nature of the contractual and legal requirements for these agreements will likely vary from situation to situation, certain minimum provisions can be expected in each agreement. These minimum provisions might include:

- Initial rates and provisions for rate modification
- Downtime provisions
- Termination and continuing operations
- Insurance
- Security requirements necessary to back project financing
- Waste quantity and quality requirements.

Obviously the structure of any agreement must need to strike a balance between protecting the financial interest of all participants while avoiding unnecessary provisions that may preclude participation.

Section 5

EVALUATION AND PRELIMINARY SCREENING OF SLUDGE CO-COMBUSTION FACILITY ALTERNATIVES

This section consists of an evaluation and preliminary screening of sludge co-combustion systems and energy recovery and production systems for the County sludge co-combustion facility. In addition, the use of waste wood chips and/or pallets as an auxiliary fuel and facility siting options are evaluated. To help identify emerging technologies that could be employed to optimize the sludge co-combustion facility, a thorough examination of the literature was conducted. Appendix F contains a summary of the literature research.

PRELIMINARY SCREENING OF SLUDGE CO-COMBUSTION SYSTEMS

This section consists of an evaluation and screening of various sludge co-combustion systems. The goal of the sludge co-combustion system is to reduce the volume of sludge produced by each of the participants by completely oxidizing the sludge organic residue and retaining any heavy metals in the ash, while producing a stabilized ash and high quality exhaust gases. The following screening criteria were used in the evaluation:

- Applicability of the process to the proposed paper mill sludge and municipal sewage sludge mixture
- Characteristics of the residuals produced from the process
- Characteristics of the exhaust gases produced from the process
- Construction cost estimates
- Operation and maintenance cost estimates
- Ability of the process to accept variations in sludge characteristics; and
- Ease of operation.

Three types of sludge incinerators were evaluated. Based on the evaluation, one type of sludge incinerator was recommended for the sludge co-combustion facility. The incinerator was evaluated first because it is the key design parameter of the proposed sludge co-combustion facility. The type of sludge incinerator used will determine the optimum type and configuration of sludge handling and feed systems, sludge dewatering and/or drying systems, off-gas treatment systems, ash handling systems, and energy recovery systems. The results of evaluating sludge dewatering and drying systems are also presented in this section. Finally, a description of the recommended sludge co-combustion system is provided.

Sludge Incinerators

The incinerators that were evaluated include rotary kiln incinerators, multiple-hearth incinerators, and fluidized-bed incinerators.

Rotary Kiln Incinerator. A rotary kiln incinerator consists of a large rotating kiln drum, lined with fire brick to minimize heat loss through the outer shell. As the kiln rotates, sludge tumbles through the cylinder, causing turbulence, thereby allowing the surface area of the solids to be exposed for combustion. Rotary kiln incinerators typically consist of primary and secondary combustion chambers to ensure complete sludge combustion. Sludge is dried in the primary chamber and combusted in the secondary chamber.

Based on the investigation of rotary kiln incinerators, a rotary kiln incinerator is not recommended for this application. A rotary kiln incinerator is not typically used for municipal sewage sludge and/or paper mill sludge. The incinerator is designed for coarse substances such as municipal solid waste. When sludge is fed to the incinerator, it tends to ball-up and char on the outside. In addition, a rotary kiln incinerator requires a high influent total solids content; typically the influent solids content must be greater than 60% to ensure proper combustion and, therefore, sludge drying would be required after dewatering. Another disadvantage of rotary kiln incinerators is that there are many moving parts that could cause operating problems. Rotary kiln incinerators also have a higher capital cost than other types of incinerators. In addition, an afterburner would be required to meet air emission standards. For all of these reasons, a rotary kiln incinerator is not recommended for this application.

Multiple-Hearth Incinerator. A multiple-hearth incinerator consists of a vertically-oriented, cylindrically-shaped, refractory-lined, steel shell containing a series of stacked horizontal refractory hearths. A hollow rotating shaft runs through the center of the hearths. Rabble arms are attached to the center shaft above each hearth. Combustion air enters at the bottom of the hearth and circulates upward through the drop holes in the hearths, countercurrent to the sludge flow, and exhausts through the top hearth to air pollution control equipment. Sludge solids flow is generally downward through the incinerator, but the movement is a combination of outward and inward radially descending travel on successive hearths, interspersed by drops of several feet through either peripheral holes in the hearth (out-hearth) or annular openings at the center (in-hearth). In the next hearth, sludge is raked in the opposite direction and this process continues on subsequent hearths as the sludge dries and burns. In addition to moving the sludge, the raking process

cuts and opens the sludge cake, thereby exposing new surfaces of the solid material to the drying and combustion processes.

The multiple-hearth incinerator includes three zones: the drying zone, combustion zone, and cooling zone. In the upper hearths, or drying zone, most of the water is evaporated from the sludge. The temperature rises through the drying zone from approximately 800 to 1400°F. In the central hearths, or combustion zone, the dry sludge combustibles are burned at temperatures of 1400 to 1700°F. Volatile gases and solids burn in the upper-middle hearths, and fixed carbon burns in the lower-middle hearths. In the lowest hearths, or cooling zone, incoming combustion air cools the ash to temperatures between 200 to 400°F. Dry ash is discharged from the bottom of the incinerator.

The major advantages of using a multiple-hearth incinerator are:

- Multiple-hearth incinerators can accept wide variations in sludge feed and sludge characteristics.
- The fuel consumption per pound of sludge is relatively constant in multiple-hearth incinerators, even at reduced sludge feed rates.
The majority of ash is collected dry and does not require additional dewatering prior to final disposal.
- Multiple-hearth incinerators have been widely used for municipal sewage sludge and the technology is well developed.

The major disadvantages of using a multiple-hearth incinerator are:

- There are many moving parts in a multiple-hearth incinerator (for example, hearths, rabble arms, and teeth) that can cause problems because of routine failure.
- Odors and unburned hydrocarbons that may have vaporized off the incoming sludge during its drying phase require that an afterburner be installed to meet air emission standards. In addition, metals vaporization can occur in localized high temperature zones.
- Multiple-hearth incinerators have a higher capital cost than other incinerators.
- Multiple-hearth incinerators have higher operation and maintenance costs than other incinerators.
- The multiple-hearth combustion process is less turbulent than the fluidized-bed combustion process, and therefore requires more excess air. Excess air is the air supplied in addition to the quantity required for stoichiometric combustion.
- Because of long heating up and cooling down times, a multiple-hearth incinerator is not suitable for intermittent operation.

Fluidized-Bed Incinerator. A fluidized-bed incinerator consists of a vertically-oriented, cylindrically-shaped, refractory-lined, steel shell with a typical diameter of 9 to 25 feet. The incinerator contains a sand bed supported on a refractory-lined grid or orifice plate with tuyeres through which combustion air is injected to fluidize the bed.

When fluidized, the sand bed in a fluidized-bed incinerator expands to approximately double its at-rest volume and becomes a suspended mass. The high velocity air through the inert sand bed increases the surface area, improves heat transfer, and promotes complete and turbulent mixing of the sludge and combustion air. Dewatered sludge is fed directly into or above the fluidized bed. In the bed, sludge moisture evaporates and the sludge volatile fraction burns at temperatures of 1400 to 1600°F. Combustion gases and ash discharge from the top of the incinerator. Entrained ash is typically separated from the combustion gases by a venturi scrubber.

A variety of auxiliary fuels can be used in fluidized-bed incinerators, including natural gas, oil, coal, wood chips, sawdust, spent oil and solvents, and prepared garbage. In the fluidized-bed incinerator, auxiliary fuel is added directly to the bed in the primary combustion zone. No. 2 fuel oil is often used in fluidized-bed incinerators because of its wide availability and ease of handling. A dual-fueled system is often provided when there is an opportunity to take advantage of variable or seasonal price differences between two fuels.

The major advantages of a fluidized-bed incinerator are:

- There are no moving parts in a fluidized-bed incinerator; this reduces maintenance problems and associated down-time.
- A fluidized-bed incinerator has a lower capital cost than other incinerators (multiple-hearth incinerators and rotary kiln incinerators).
- The Sewer District has over 16 years of experience in operating a fluidized-bed incinerator.
- The Sewer District's existing fluidized-bed incinerator is known to operate well with the Sewer District's municipal sewage sludge and TAGSONS' paper mill sludge.
- A fluidized-bed incinerator is suitable for intermittent operation and frequent start-ups and shutdowns as the combustion chamber cools very slowly.
- Because of the slow cooling of the fluidized-bed combustion chamber, less preheat is needed in a fluidized-bed incinerator than other types of incinerators.
- A fluidized-bed incinerator operates satisfactorily with low solids content wastes, although with a low-solids content, auxiliary fuel may be required to evaporate the water.

- Because of the automated operation, minimal operator attention is required to operate a fluidized-bed incinerator.
- An afterburner is typically not required to meet air emission requirements.

The major disadvantages of a fluidized-bed incinerator are:

- A fluidized-bed incinerator cannot accept wide variations in sludge feed rates and sludge characteristics.
- All of the ash is discharged with the scrubber water and the slurry must be dewatered if it is to be landfilled.

Recommended Sludge Incinerator. Based on the review of rotary kiln incinerators, multiple-hearth incinerators, and fluidized-bed incinerators, it is recommended that a fluidized-bed incinerator be the combustion technology for this project. The fluidized-bed incinerator is recommended because it has been used with good success by the Sewer District on a mixture of municipal sewage sludge and paper mill sludge. Fluidized-bed incinerators have also been successfully used in combusting sewage sludge and paper mill sludge at other locations as identified in the literature research. Finally, it is expected that the fluidized-bed incinerator will have the lowest capital costs and the lowest operation and maintenance costs of all the available technologies.

Sludge Dewatering and Drying Systems

All of the participants currently dewater their sludge. Table 5-1 shows a summary of each participant's existing sludge dewatering practice.

Table 5-1. Summary of Existing Sludge Dewatering Practice.		
PARTICIPANT	SLUDGE PERCENT SOLIDS	EXISTING DEWATERING EQUIPMENT
Cottrell Paper Company	22	Belt Filter Press
Encore Paper Company	30	Belt Filter Press
International Paper Company	45	Screw Press
Mohawk Paper Mills	43	Screw Press
TAGSONS Papers & Saratoga County Sewer District No. 1	25	Belt Filter Press
WEIGHTED AVERAGE	34	

Because Cottrell, Encore, International Paper, and Mohawk currently have on-site sludge dewatering facilities, these mills should continue to dewater their sludge on-site to the maximum total solids content attainable with their existing equipment. The incentive for these companies to maximize the sludge solids content at their mills would be the transportation cost savings that result from reduced sludge volumes.

The optimum total solids content for the influent to the combustion process is the key design parameter in determining the recommended total solids content from the dewatering and/or drying process. Based on using a fluidized-bed incinerator, the optimum solids content for the proposed sludge influent to the combustion process would be approximately 45%. At a lower influent solids content, large quantities of auxiliary fuel are required to evaporate the water. At a higher influent solids content, operating problems can develop and the combustion process can be difficult to manage. For example, if the temperature inside the fluidized-bed incinerator becomes too hot, spray cooling water is required to cool the system and slag may form.

Based on each participant using their existing facilities to dewater their sludge on-site to the solids content shown in Table 5-1, the combined average solids content of the sludge received by the co-combustion facility would be approximately 34%. As can be seen from Table 5-1, a belt filter press can dewater sludge to approximately 22 to 30% solids, and a screw press can dewater paper mill sludge to approximately 43 to 45% solids. It has been assumed that the County's two existing belt filter presses would be relocated to the new facility and they would continue to be used to dewater the municipal sewage sludge and TAGSONS' paper mill sludge.

For the incinerator influent total solids content to be 45%, the dewatered sludge from the Sewer District, TAGSONS, Encore, and Cottrell would need to be further dewatered or dried. To dewater the sludge, a screw press could be used. A multi-stage screw press consists of a full-length screw designed with flights of decreasing pitch arrayed on cones of increasing diameter. As sludge moves through the press, the decrease in pitch and increase in cone diameter exerts pressure on the sludge. Each stage exerts higher pressures and consequently forces more liquid out of the sludge.

In general, mechanical dewatering methods, such as belt filter presses and screw presses, are more efficient per volume of water removed from sludge than thermal drying methods. However, mechanical methods are not able to obtain the low moisture levels attainable with thermal drying methods. Thermal dryers are able to dewater sludges to solids contents of approximately 95%. There are several types of thermal sludge drying equipment available, including direct sludge dryers and indirect sludge dryers. Based on a review

of several sludge dryers, it was determined that a thermal sludge drying system would not be the optimum sludge dewatering method for the sludge co-combustion facility. Thermal sludge dryers are efficient when a high solids content needs to be obtained. However, to avoid operating problems with the fluidized-bed combustion process, the influent sludge feed must not be too dry. Therefore, the sludge should be dewatered to approximately 45%, and a screw press would be more efficient than a thermal dryer to increase the solids content of the paper mill and municipal sewage sludge mixture to approximately 45% solids.

Recommended Sludge Co-Combustion Facility

Figure 5-1 shows the solids processing diagram for the proposed sludge co-combustion facility. Paper mill sludge from each of the participants would be delivered to the facility. To achieve a solids content of approximately 45%, dewatered sludge from Cottrell, Encore, TAGSONS, and the Sewer District would be further dewatered by screw presses at the sludge co-combustion facility. The sludge produced by International Paper and Mohawk would not require further dewatering.

Once all of the sludge is dewatered to approximately 45% solids, it would be combined and then fed into two fluidized-bed incinerators. After the sludge is combusted, the ash would exit the fluidized-bed incinerators with the exhaust gases and enter energy recovery systems. The ash and exhaust gases would then enter wet scrubber systems to separate and cool the ash and exhaust gases. The ash slurry would enter an on-site ash dewatering system. From the on-site ash dewatering system, the ash would be conveyed to a storage bin.

PRELIMINARY SCREENING OF ENERGY PRODUCTION OPTIONS

Description of Energy Production Options

The primary recoverable energy in the sludge incineration process is the heat contained in the incinerator off-gas. As discussed in Section 4, the Sewer District, TAGSONS, and/or NYSEG are potential energy customers for the energy products of the co-combustion facility. The following three energy production options were evaluated:

- Option 1 - Produce 100% of TAGSONS' steam demand.
- Option 2 - Produce steam for sale to TAGSONS and produce electricity from an engine / generator set.

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FIGURE NO. 5-1

SOLIDS PROCESSING DIAGRAM

Option 3 - Produce steam for sale to TAGSONS and produce electricity from a gas turbine / generator set.

Option 1. Option 1 consists of two heat recovery steam generators (HRSGs) and one standby steam boiler. Figure 5-2 is a schematic of this option. HRSGs for the off-gas of fluidized-bed incinerators are typically supplied by the incinerator manufacturer as part of the incineration system package. The literature research identifies several existing facilities that use HRSGs to produce steam from incinerator off-gas. Based on the proposed sludge feed characteristics, approximately 16,200 lb/hr of steam would be produced by each HRSG. Thus, a total of approximately 32,400 lb/hr of steam would be produced. To meet TAGSONS' peak steam demands, a 25,000 lb/hr natural gas-fired standby boiler would be provided.

Option 2. Option 2 consists of the two HRSGs described for Option 1 and the installation of a 5,030 bhp engine / generator set to produce 4 MW of electricity. Figure 5-3 is a schematic of this option. A 4 MW engine / generator set was selected to match the electric demands of TAGSONS. It has been assumed that with load management of the peak electric demand, a 4 MW engine/generator would match TAGSONS' electric demands. Modern, dual-fuel, low-speed, continuous-duty engine / generator sets have excellent availability capabilities, normally well over 90%. In addition, the engine exhaust and cooling systems are an excellent source of low-quality heat and steam for process and space heating and cooling systems. The heat rate for the selected engine / generator set is 6,250 Btu/bhp-hr. The engine / generator set would be equipped for dual-fuel firing of No. 2 fuel oil and natural gas. The heat from the exhaust gas would be recovered and used to generate steam. The waste heat from the engine / generator set would produce approximately 9,000 lb/hr of steam at 85 psig to supplement the steam generated by the two HRSGs. Electrical equipment would be installed to accomplish the power distribution sequencing necessary to feed the incoming service from the utility. The benefit of using an engine-driven/generator set would be the revenue that could be received from the sale of electricity. The disadvantage of this option is the lack of a continuous thermal user for the low-quality thermal product.

Option 3. Option 3 consists of the two HRSGs described for Option 1 and the installation of gas turbine / generator set to produce electricity. Figure 5-4 is a schematic of this option. The heat rate of modern, high-speed, steam-injected, gas turbine / generator sets is in the range of 8,950 Btu/kWh. The heat rate for the selected turbine is 8,938 Btu/kWh. These generator sets have excellent availability capabilities, typically greater than 95%. In addition, the turbine exhaust is an excellent source of high-quality heat for steam generation or for use as a hot air source. The gas turbine / generator set would be equipped for dual-fuel firing of either No. 2 fuel oil or natural gas. The heat from the exhaust gas would be recovered

FILE NAME R:\2753R\22\FIG5-4.DWG

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FIGURE NO.

5-4

**ENERGY PRODUCTION
OPTION NO. 3**

to generate steam. The boiler would have supplemental natural gas firing capabilities. Electrical equipment would be installed to accomplish the power distribution sequencing necessary to feed the incoming service from the utility. The advantage of a gas turbine / generator set is that TAGSONS' electric demand could be matched more efficiently than with an engine / generator set. The steam injection capabilities of the gas turbine / generator set would allow the operators to closely follow TAGSONS' electrical load. The disadvantage of this option is the lack of a continuous thermal user for the thermal product.

Preliminary Cost Estimates of the Energy Production Options

To evaluate the economic feasibility of the three energy production options, preliminary cost estimates were developed. Table 5-2 summarizes the estimated total construction costs, first-year debt service cost, first-year operation and maintenance costs, first-year steam revenues, first-year electric revenues, and the resulting estimated net revenue for the three options.

The construction cost estimates are based on manufacturer's data for the facilities shown in Figures 5-2, 5-3, and 5-4. The costs include equipment costs, freight costs, labor and installation costs, professional fees, and contractor overhead and profit. The first-year debt service costs are based on the 50%-rule of bond repayment for a 20-year general obligation bond at an interest rate of 7.0%. The estimated first-year operation and maintenance costs include the estimated labor costs, utility costs, water supply costs, and general maintenance costs. Labor costs include all salaries and benefits for facility staff. Utility costs assume a natural gas cost of \$0.47/therm, an 85% availability for the engine / generator set, and a 95% availability for the gas turbine / generator set. Water supply costs include the cost to purchase and treat the boiler feedwater. It has been assumed that the City of Mechanicville water supply would be used at a cost of approximately \$1.52/1,000 gallons. General maintenance includes the costs for maintaining all process equipment and amenities.

The total estimated first-year revenue would include the revenue received from the sale of the energy products produced by the co-combustion facility. The estimated steam revenue is based on TAGSONS' avoided energy and water purchase costs for steam production. The estimated electric revenue is based on selling all of the electricity produced by the facility at a cost of \$0.0625/kWh. If all of the electricity could not be used on-site, then the electric revenue would be lower than shown in Table 5-2. In the event that the power production equipment is down, it has been assumed that NYSEG would be used as an

TABLE 5-2. Preliminary Cost Estimates for the Energy Production Options.			
ITEM	OPTION 1	OPTION 2	OPTION 3
CAPITAL COSTS			
Standby Boiler	\$180,000	N.A.	N.A.
4.6 MW Engine/Generator Set and HRSG	N.A.	\$2,800,000	N.A.
6.6 MW Gas Turbine/Generator Set and HRSG	N.A.	N.A.	\$4,644,000
Ancillary Equipment	\$150,000	\$640,000	\$1,500,000
Piping & Mechanical Equipment	\$150,000	\$676,400	\$600,000
Feed Water System	\$100,000	\$100,000	\$100,000
Structural Improvements	\$150,000	\$150,000	\$400,000
Utility Improvements	\$60,500	\$60,500	\$60,500
Subtotal:	\$790,500	\$4,426,900	\$7,304,500
Contingencies	\$79,050	\$442,690	\$730,450
Planning & Permitting	\$43,500	\$243,480	\$401,700
Engineering, Legal, Fiscal, & Administration	\$86,950	\$486,930	\$803,450
TOTAL CAPITAL COST:	\$1,000,000	\$5,600,000	\$9,240,100
FIRST-YEAR DEBT SERVICE COST:	\$110,000	\$616,000	\$1,016,410
OPERATION & MAINTENANCE COSTS			
Labor	\$75,000	\$150,000	\$150,000
Utility	N.A.	\$1,111,900	\$2,322,000
Water Supply	\$60,000	\$60,000	\$60,000
General Maintenance	\$25,000	\$250,000	\$250,000
FIRST-YEAR OPERATION & MAINTENANCE COST:	\$160,000	\$1,571,900	\$2,782,000
ANNUAL REVENUE			
Steam	\$2,060,000	\$2,060,000	\$2,060,000
Electric	\$0	\$1,861,500	\$1,872,450
FIRST-YEAR TOTAL REVENUE:	\$2,060,000	\$3,921,500	\$3,932,450
ESTIMATED FIRST-YEAR NET REVENUE:	\$1,790,000	\$1,733,600	\$134,040
N.A. = Not Applicable			

emergency power source. The use of a public utility as an emergency power resource is guaranteed, at non-discriminatory prices, by the Public Utilities Regulatory Policy Act of 1978. However, the user would incur demand charges and therefore credits for demand charges were not included in the economic analysis.

Based on the costs shown in Table 5-2, Option 1 is the recommended energy production option. This option is recommended because it has the highest total net revenue.

WASTE WOOD

The feasibility of using clean waste wood chips and/or pallets as a supplementary fuel in the fluidized-bed incinerators was evaluated. Waste wood could be used either as a primary fuel or as an auxiliary fuel to supplement variations in sludge production. Per the literature research (Appendix F), there are existing fluidized-bed incinerators that use wood as a fuel source.

The major advantages to using clean waste wood at the County sludge co-combustion facility are:

- An additional fuel source would increase the operational flexibility of the facility.
- More steam could be produced and, if a thermal user could be found, the facility could generate more revenue from selling steam.
- The use of waste wood would result in a reduction in the use of other types of auxiliary fuels (e.g. natural gas, fuel oil) to sustain combustion, and, therefore, would result in cost savings for the other fuels.

The major disadvantages of using clean waste wood at the County sludge co-combustion facility are:

- The facility would have a higher capital cost due to the following:
 - Larger fluidized-bed incinerators would be required to burn the wood and sludge mixture.
 - Additional storage and handling equipment would be required for the wood.
 - The larger incinerators, energy recovery systems, and wood handling equipment would require additional building area.
- Some of the facility's operating costs would be higher due to the following:
 - Additional labor would be required for ordering, receiving, inspecting, quality control testing of the wood, and for

increased maintenance associated with the wood storage, conveying, and feed systems.

- Additional electric costs would be due to higher energy requirements of the incinerators and wood feed equipment.
 - Additional expense would be due to the purchase of wood.
 - Additional wastewater treatment costs would be due to increased wastewater production.
 - Additional ash disposal costs would be due to increased ash production.
- The project would have a greater risk since the facility's economic viability would be dependent upon receiving an adequate quantity and quality of clean waste wood at a reasonable price.

To determine the feasibility of using clean waste wood chips and/or pallets, preliminary cost estimates were developed. A summary of the preliminary cost estimates and a list of the major assumptions used to develop the costs is contained in Appendix G. Based on these preliminary cost estimates, the facility using wood would have a total estimated capital cost of approximately \$2,210,600 more than the facility not using wood. The total first-year annual operation and maintenance costs for the facility using wood would be approximately \$2,633,125 versus \$3,086,020 without using wood. Finally, the facility using wood would produce approximately 6,000 lb/hr more steam.

Based on the preliminary cost estimates, it was determined that if the Sewer District could purchase waste wood chips and/or pallets at a cost of approximately \$20/ton, including delivery, then the use of waste wood at the County co-combustion facility would be recommended. Based on a \$20/ton cost for wood, the decrease in operating costs due to the reduction in the use of other auxiliary fuels would support the additional costs necessary to construct, operate, and maintain the facility using wood. However, as previously stated, the use of waste wood would result in a greater risk to the Sewer District since the facility would be dependent on an adequate long-term supply of wood. For the purposes of this report, it has been assumed that an adequate supply of wood would be available, and that the facility would be designed with the capability of using both wood and No. 2 fuel oil as supplemental fuels, but that clean waste wood chips and/or pallets would be the preferred supplemental fuel.

FACILITY SITING

There are two possible siting options for the proposed co-combustion facility: adjacent to the County wastewater treatment plant or adjacent to TAGSONS. It has been assumed that the sludge co-combustion facility would be located adjacent to the County treatment plant. This section describes the advantages and disadvantages of locating the facility at the plant versus TAGSONS Papers. The major advantages of locating the sludge co-combustion facility at the County treatment plant are:

- The Sewer District would own, operate, and maintain the facility. It would be more convenient for the Sewer District to have all of the wastewater and sludge processing facilities in one location.
- The wastewater generated by the facility will need to be treated at the County wastewater treatment plant; thus, added costs for the conveyance of this wastewater are kept to a minimum.
- Wastewater sludge produced by the Sewer District could be readily conveyed to the new facility by a relatively short pipeline.
- Space is available adjacent to the County wastewater treatment plant, but is limited at TAGSONS.

The major disadvantages of locating the sludge co-combustion facility at the County wastewater treatment plant are:

- Increased construction costs would be due to the installation of steam piping between the facility and TAGSONS.
- Increased construction costs would be due to the installation of natural gas service to the facility.
- TAGSONS is a larger electric consumer than the Sewer District. If, in the future, the facility were to be expanded to produce electricity, then TAGSONS would be able to use all of the electricity produced.
- Paper mill sludges produced by TAGSONS will need to be conveyed through a relatively long pipeline or truck transported to the County treatment plant.
- The economic feasibility of expanding the co-generation facilities in the future to serve new thermal customers would be adversely affected because of regulatory restrictions that govern the off-site sale of power.

Based on the uncertainty regarding new development with thermal needs, space considerations, and operating preferences, it is recommended that the sludge co-combustion facility be located adjacent to the County wastewater treatment plant. Construction costs for the installation of a sludge forcemain between

the treatment plant and TAGSONS have not been included in the analysis since TAGSONS is currently planning to install this forcemain. For the purpose of this report, it has been assumed that the sludge co-combustion facility would be located adjacent to the County wastewater treatment plant.

Section 6

EVALUATION OF RESIDUALS MANAGEMENT OPTIONS

Although the co-combustion process would reduce the total volume of sludge provided by the participating paper companies and the Sewer District's wastewater treatment plant, the ash produced by the co-combustion process would still need to be disposed of in an environmentally sound manner. Based on the future projected sludge quantities and characteristics, it is estimated that an average of approximately 116 tons/day of ash, at a solids content of approximately 50%, would be produced at the facility. In general, ash has a mild, inoffensive odor, and is chemically inert. Final ash disposal options evaluated in this section include: on-site ash disposal, off-site ash disposal, and beneficial use options.

ON-SITE ASH DISPOSAL

This ash disposal option consists of the construction of an ash monofill at the County sludge co-combustion facility. The monofill would contain only the ash produced by the co-combustion facility. The ash monofill would be permitted and constructed in accordance with the requirements of the 6 NYCRR Part 360 and EPA 40 CFR Part 503 regulations. The NYSDEC's requirements for a monofill are based on the pollution potential of the waste. Pollution potential is based on the volume, variability, and the physical, chemical, and biological properties of the waste. The permitting of a monofill would require the preparation of engineering plans, reports, and supporting documentation that describe all aspects of the monofill development, operation, closure, and post-closure. Two permits are required by the NYSDEC: a permit to construct and a permit to operate the facility.

Monofill costs would include the costs associated with land acquisition, land burial equipment, construction, design, labor, insurance, and regulatory fees. Adequate land area would be required for the development and operation of all monofill-related facilities, including: leachate collection and treatment facilities, drainage structures, access roads, maintenance buildings, and landscaped buffer zones around the perimeter of the monofill. To minimize transportation costs, the ash monofill would be constructed as close to the co-combustion facility as practical. The estimated tipping fee for a NYSDEC permitted monofill is approximately \$100/ton.

OFF-SITE ASH DISPOSAL

This ash disposal option consists of three possible off-site options including: an off-site ash monofill; off-site disposal at the proposed Saratoga County landfill; and off-site disposal at an approved out-of-County landfill.

Off-Site Ash Monofill

The construction of an off-site ash monofill would be similar to the on-site monofill option previously described. The only difference would be increased operating costs to transport the ash off-site. The exact site for an off-site ash monofill would be established by conducting an extensive screening and selection process.

Off-Site Ash Disposal at the Proposed Saratoga County Landfill

In accordance with Saratoga County's Solid Waste Management Plan, the County is in the process of permitting and designing a landfill to accept municipal waste generated within the County. Also in accordance with the County plan, the proposed landfill will not accept paper mill sludge generated by the paper companies within the County. This ash disposal option consists of disposing the ash produced by the County co-combustion facility at the proposed County landfill. The major costs associated with this option are ash transportation costs and landfill tipping fees.

It is expected that the Saratoga County landfill will be located off Kober Road in the Town of Northumberland, Saratoga County, New York. The distance from the County wastewater treatment plant to the landfill is approximately 35 miles. Based on the future projected average ash production of approximately 116 wet tons/day, it is estimated that an average of 5 hauls/day using a 30-cubic yard truck would be required. The total estimated cost for transporting the ash this distance is approximately \$10/ton. This cost could be reduced if an agreement is reached with Encore such that the trucks that Encore would use to transport sludge to the co-combustion facility would be used to transport ash to the proposed landfill on the return trip.

To date, the tipping fees at the proposed landfill have not been established. Therefore, it is difficult to determine the exact cost for this option. Typical landfill tipping fees for newly permitted landfills are in the range of \$80 to \$100/ton. There have been preliminary discussions between the County Solid Waste Commission and the County Sewer District to determine if the Sewer District would be able to treat the

leachate produced by the proposed County landfill. If the Sewer District were able to accept leachate, there could possibly be an exchange made with the ash and the leachate. This occurs in Albany County, where the North Albany wastewater treatment plant accepts and treats the Town of Colonie's landfill leachate, and in return the landfill accepts and disposes of the wastewater treatment plant incinerator's ash. Such an arrangement for Saratoga County is purely speculative, and therefore is not assumed for this study.

Off-Site Ash Disposal at an Approved Out-of-County Landfill

This ash disposal option assumes that ash produced by the sludge co-combustion facility would be landfilled in an approved out-of-County landfill. The major costs associated with this option would be ash transportation costs and landfill tipping fees. Landfills, such as the Town of Colonie, are currently charging a tipping fee of approximately \$60/ton. Thus, a tipping fee of approximately \$70/ton, including transportation costs is assumed for an out-of-county landfill.

BENEFICIAL USE DETERMINATION

Identifying a beneficial use for the ash produced by the co-combustion facility could significantly reduce residuals disposal costs. Potential beneficial uses of ash include use as an interim barrier layer in a landfill, use as a raw material in building materials, and use as a raw material in asphalt mixtures. Appendix H contains a list of existing NYSDEC approved beneficial use determination permits for sewage sludge, paper mill sludge, and ash. Based on this list, there are several existing approved beneficial uses for ash, including the use of ash for the following:

- As a raw material in the manufacture of cement
- As an aggregate in concrete
- As flowable fill
- As a traction agent on roadways
- As a soil supplement in composting and/or soil fertilizer
- To produce hot mix asphalt
- As daily cover, gas venting, and grading material at landfills
- As road subbase.

Based on the existing NYSDEC beneficial use determination permits, the two most probable beneficial uses for the ash produced by the co-combustion facility are as a raw material in the manufacture of cement and as cover material at landfills. The use of power plant fly ash for improving the structural characteristics

of cement and other building materials is widely known and employed. Its use is encouraged by federal guidelines, including the U.S. EPA, "Cement and Concrete Containing Fly Ash; Guideline for Federal Procurement" Federal Register, 1983. The use of sewage sludge ash and paper mill sludge ash in the manufacture of cement is not as widely known. The literature research in Appendix F summarizes some studies that have been performed to determine the structural characteristics of sewage sludge ash.

To determine the feasibility of beneficially using the ash produced by the co-combustion facility in the manufacture of cement, several area cement manufacturers were contacted. Based on our correspondence, the Independent Cement Corporation was the only manufacturer who would currently consider accepting ash. Independent Cement Corporation, located in Catskill, New York, currently has several approved beneficial use determinations for using ash as a substitute for red shale in the manufacture of cement. Based on correspondence with the Independent Cement Corporation, they would negotiate a contract with the supplier based on the specifics of the ash, including ash quantity and quality. It would be the ash generator's responsibility to obtain a NYSDEC beneficial use determination permit in accordance with the provisions of the Part 360 regulations.

To obtain a beneficial use determination permit, a generator of a waste may petition the NYSDEC in writing. The petition must: describe the proposed method of application or use of the waste; demonstrate that there is a known or potential market for the intended use of the waste; and demonstrate that the intended use will not adversely affect the public health and safety, and the environment.

In addition to beneficially using ash as a raw material in the manufacture of cement, it is possible that the ash produced by the co-combustion facility could be beneficially used as an interim barrier layer at landfills. As shown in Appendix H, there are several existing NYSDEC approved beneficial use determination permits that allow the use of municipal sewage sludge, paper mill sludge, and ash as daily cover material at landfills. One opportunity for this beneficial use would be as an interim barrier layer material at the proposed County landfill. Use of the ash for this purpose may require that it be blended with soil prior to application to enhance the structural properties of the material. Nonetheless, the reduction in purchased material required by the County would likely offset any additional costs for material blending, making this a highly desirable end use for the residuals of the co-combustion facility.

RECOMMENDED RESIDUALS MANAGEMENT OPTION

It is recommended that beneficial use be the preferred ash disposal option. It is believed that beneficially using the ash produced by the co-combustion facility would be the most economically feasible and

environmentally acceptable ash disposal option. For the purpose of this study, it has been assumed that all of the ash could be beneficially used within a 35-mile distance from the co-combustion facility, and that the only costs associated with ash disposal would be the costs to transport the ash to the beneficial user. The estimated cost for transporting the ash within a 35-mile distance is \$10/ton.

Section 7

PROPOSED SLUDGE CO-COMBUSTION FACILITY

PRELIMINARY DESIGN

Figure 7-1 shows the solids processing diagram for the proposed sludge co-combustion facility. Figure 7-2 shows the preliminary facility site plan. Paper mill sludge from Cottrell, Encore, International Paper, and Mohawk would be trucked daily by the paper mills to the proposed facility site, where the sludge would be deposited into four live-bottom sludge receiving hoppers. A truck weigh station would be provided at the facility entrance to provide a means of weighing each truck upon entering the facility. Each of the paper companies would have a designated sludge hopper that would be designed to store one day's average production of paper mill sludge. If the hopper is full when the truck arrives from the paper mill, the sludge would be sent to an on-site temporary sludge storage area. The storage area would be a pole-barn, designed to store a maximum of five days of dewatered sludge from the participants. A front-end loader would be provided to transfer sludge from the temporary storage area to the live-bottom hoppers, as needed. During normal operation, the temporary sludge storage area would not be used.

Sludge from TAGSONS and the Sewer District would be pumped at approximately 4% solids from each facility to below-grade concrete wet wells, which would be located adjacent to the proposed building. To reduce the potential for odors, the sewage sludge and paper mill sludge would be stored in separate wet wells. Each of the wet wells would be designed to store 1 day's average future production of sludge from TAGSONS and the Sewer District.

To achieve the desired incinerator feed solids content of approximately 45%, sludge from Cottrell, Encore, TAGSONS, and the Sewer District would need to be further dewatered by two screw presses at the sludge co-combustion facility. Cottrell and Encore's sludge would arrive at the facility at a total solids content of approximately 22% and 30% solids, respectively, and these sludges would be mixed together and conveyed from the sludge storage hoppers to a screw press. Sludge from TAGSONS and the Sewer District would be pumped from the wet wells to the two relocated belt filter presses. The belt filter presses would increase the solids content of TAGSONS and the Sewer District's sludge from approximately 4 to 25%. From the belt filter presses, the sludge from TAGSONS and the Sewer District would be further dewatered by a screw press to increase the solids content to approximately 45%. The sludge produced by International Paper and Mohawk would be delivered to the facility at approximately 43% and 45% solids,

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
SLUDGE, TPD	89	4.6	2.5	250	667	375	93.7	252.5	133.0	237.1	330.8	165.4										116			
DRY SOLIDS, TPD	40	2	0.6	75	20	15	42	75.6	33.3	106.7	148.7	74.3		21.62				29.0	57.9			57.9		1.75	2.2
WOOD, TPD														25.44											
TOTAL SOLIDS, %	45	43	22	30	3	4	45	30	25	45	45	45		85				3	3			50		0.1	1.5
FLOW, GPD	21,121	1,105	594	59,404	159,872	89,928	22,226	59,998	31,603	56,327	78,553	39,276			192,960	453,600		232,237	464,474	395,644	41,298	27,532	144,000	362,197	35,274
FLOW, GPM	14.7	0.8	0.4	41.3	111.0	62.5	15.5	41.7	21.9	39.1	54.5	27.3			134	315		161.3	322.6	274.8	28.7	19.1	100	251.5	24.5
FLOW, SCFM													7,970				8,657

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FIGURE NO. 7-1

**SOLIDS PROCESSING DIAGRAM
SARATOGA COUNTY SEWER DISTRICT
NO. 1 CO-COMBUSTION FEASIBILITY
STUDY**

respectively; therefore, this sludge would not require further dewatering. All of the sludge would be transported from one operation to another by sludge conveying systems.

Each of the participants' dewatered sludge would be combined downstream of the screw presses. The sludge would then be mixed together and equally split before being fed into two fluidized-bed incinerators. Each incinerator would have a reactor freeboard internal diameter of 21 feet, and each would be designed to operate continuously 24 hours/day, 365 days/year at the design sludge loadings. The reactors would operate at a temperature of 1550°F, and require 40% excess air. Based on the influent sludge's characteristics, the combustion process would not be autogenous, and, therefore, auxiliary fuel would be needed to sustain combustion. Each incinerator would have dual-fuel system capabilities so that either clean waste wood or No. 2 fuel oil could be used as an auxiliary fuel. Clean waste wood chips would be the preferred auxiliary fuel.

After the sludge is combusted, ash would exit the fluidized-bed incinerator with the exhaust gases and enter the heat recovery steam generator system. The heat recovery steam generators would produce approximately 38,400 lb/hr of steam at 600 psig. These steam conditions are different from Option 1 in Section 5 and are explained below. The ash and exhaust gases would then enter a scrubber system consisting of a high-energy venturi, separator, and tray cooler. The primary function of the system is to cool, wet, agglomerate, and remove particulates and gases from the flue gases and vapors before they are discharged to the atmosphere. The temperature of the flue gases and vapors would be reduced to approximately 120°F. Secondary effluent from the County wastewater treatment plant would be used for the venturi water and tray cooling water. Most of the ash particles would be contained in the spent venturi scrubbing water; therefore, the water used for the venturi would be segregated from the tray cooling water discharge. The spent venturi water would be recovered in the separator located at the bottom of the tray cooler, and would be processed for ash removal, while the spent cooling water would be recycled to the influent of the County wastewater treatment plant. From the cooling tower, the air and gases would exit through a common stack with a continuous emissions monitoring system.

Based on the Sewer District's past experience with ash separation, it was determined that on-site mechanical ash dewatering facilities would be desirable. A gravity thickener followed by a rotary vacuum drum filter would be used. The ash slurry would exit the scrubber system, and would be pumped to a gravity thickener. The thickened ash slurry would then be further dewatered on-site by a rotary vacuum filter. The rotary vacuum filter would increase the ash solids content to approximately 50%. Testing of the ash would be necessary to determine the exact type and concentration of coagulants needed. From the vacuum filter, the ash would be conveyed to an ash storage bin for short-term storage prior to being

transported to the ultimate ash disposal site. The temporary ash storage bin would be designed to store a maximum of 3 days of ash production.

All of the wastewater produced by the proposed sludge co-combustion facility would be treated at the County wastewater treatment plant. The wastewater would consist of belt filter press filtrate, screw press filtrate, spent cooling water, ash gravity thickener overflow, and vacuum filter filtrate. It is estimated that a maximum of approximately 1.7 mgd of wastewater would be produced by the facility. To treat this wastewater, additional facilities would be needed at the County plant. The County is currently in the planning stages for an expansion of its existing wastewater treatment plant. It has been assumed that the additional wastewater treatment facilities needed to treat the wastewater produced from the sludge co-combustion facility would be constructed during the proposed plant expansion. The cost for the additional treatment capacity for the wastewater produced from the proposed sludge co-combustion facility would be apportioned to the sludge co-combustion facility.

The steam produced by the high-pressure heat recovery steam generators would be sold to TAGSONS. Based on the preliminary screening of energy production options presented in Section 5, it was recommended that producing steam for sale to TAGSONS was the most economically viable option of the 3 options evaluated. Based on a preliminary design using a sludge and wood chip fuel mixture, each heat recovery steam generator would produce approximately 19,200 lb/hr of saturated steam at 600 psig (38,400 lb/hr of saturated steam at 600 psig total). The preliminary design of the co-combustion facility further optimizes energy production by first raising steam at a higher pressure in the heat recovery steam generators and then reducing the pressure of the steam through a back-pressure steam turbine to produce electricity. The preliminary design of the co-combustion facility includes the use of two gas-fired superheaters and a back-pressure steam turbine. Figure 7-3 is a schematic of the proposed energy production system. This steam would be superheated to approximately 700°F and then reduced from 600 psig to 150 psig through one industrial grade, radial inflow, back-pressure steam turbine / generator system. The steam would exit the turbine with approximately 30 degrees of superheat. The steam turbine / generator set would be capable of producing approximately 1050 kW. The Sewer District would use all of the electricity produced.

The use of a gas-fired superheater at the co-combustion facility would allow increased electric production from the 600 psig steam. The electric production would increase from 575 kW for a back-pressure steam turbine with dry saturated inlet steam to approximately 1050 kW for a back-pressure steam turbine with an inlet steam temperature of 700°F.

FILE NAME W:\2753R\22\FIG7-3.DWG

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FIGURE NO.

7-3

**ENERGY PRODUCTION
PROCESS FLOW SCHEMATIC**

Superheating the steam is recommended to produce additional electricity and to eliminate the potential formation of moisture in the turbine and underground piping system. The additional costs for the superheating equipment will be offset by increased electric revenues, maintenance cost savings, and a reduction in the costs for condensate traps, pumps, and piping.

Steam would be piped from the co-combustion facility to TAGSONS via a 14-inch-diameter pipeline. TAGSONS currently does not return any of its condensate. Therefore, it has been assumed that none of the condensate would be returned to the co-combustion facility. A 40,000 lb/hr gas-fired boiler would be installed at the co-combustion facility to supplement the two heat recovery steam generators, as needed, to provide all of TAGSONS' steam demand. If TAGSONS could not use all of the steam produced by the two heat recovery steam generators, then the steam would enter an excess heat exchanger at the co-combustion facility.

No system redundancy would be provided at the proposed sludge co-combustion facility. The proposed facility would operate continuously at full capacity. Temporary sludge storage would be provided for regular system maintenance. It has been assumed that if one of the incinerators had to be taken off-line for an extended period of time (beyond 5 days), then the second unit would be operated at its maximum feed rate and the participants would be required to find an alternate means of sludge disposal for a portion of their sludge stream. The maximum sludge feed rate for one incinerator, would be approximately 220 lbs/day, based on a 45% solids content. System redundancy could be provided; however, this would increase the project cost. The proposed facility would be designed such that space would be available for additional facilities, if desired in the future. Based on the age of the Sewer District's existing fluidized-bed incineration system, it has been assumed that this system would not be used in the proposed sludge co-combustion facility. If properly maintained, the existing system could provide some sludge co-combustion redundancy. However, the existing fluidized-bed incineration system has no energy production capabilities.

Table 7-1 shows a summary of the size and type of the major equipment that could be used at the proposed sludge co-combustion facility.

Table 7-1. Proposed Sludge Management Equipment.

ITEM	BASIS OF DESIGN	POSSIBLE MANUFACTURERS	DIMENSIONS	TOTAL QUANTITY	OPERATION	TOTAL INSTALLED HP
Live-Bottom Sludge Receiving Hoppers	One Day Dewatered Sludge Storage For Cottrell, Encore, I.P., & Mohawk	Spirac Engineering	18 ft l x 60 ft w x 12 ft h total 11,880 cf total	4	Continuous	8
Sludge Pump Station	One Day Sludge Storage For Sewer District & TAGSONS	Robbins & Myers, Inc. Moyno 2000 Pump (200 gpm @ 60 TDH)	42 ft l x 42 ft w x 20 ft h total TAGSONS 160,000 gal Sewer District 90,000 gal	2	Continuous	40
Relocate Existing Belt Filter Presses	Existing Two 1-1/2 Meter Presses & Appurtenances	Belt Dewatering, Inc.	16.5 ft l x 8 ft w x 9 ft l each	2	1 Continuous (1 Stand-By)	30
Screw Presses	Dewater Cottrell, Encore, TAGSONS, & Sewer District Sludge From 20% To 45% Solids	Phoenix Process Equip. Co. Model SP-30-16 Screw Press (8.2 ton/hr/press)	30 ft l x 6 ft w x 4.75 ft h each 30 in Diameter Screw Variable Speed	2	Continuous	120
Sludge Conveyor Systems	Convey Sludge Between Processes 20% to 45% Solids	Serpentix Conveyor Corp. or Buck-El	340 ft Long Variable Speed	1	Continuous	30
Fluidized-Bed Incineration Systems	6,190 lb/hr Dry Solids 4,150 Btu/lb Dry Solids, 62% VS	Hankin Environmental Systems, Inc. Dorr-Oliver, Inc. JWP Energy Products, Inc.	20 ft Diameter	2	Continuous	930
Ash Gravity Thickener	4,700 lb/hr Dry Solids	Westech Engineering, Inc.	12 ft Diameter Thickener With 3 ft Diameter Feed Well	1	Continuous	1/2
Ash Slurry Pumps	Ash Slurry From Scrubbers To Ash Thickener	Goulds Pump, Inc. Model JC Slurry Pump (250 gpm @ 30 TDH)	N.A.	2	1 Continuous (1 Stand-By)	20
Ash Vacuum Filter	4,700 lb/hr Dry Solids	Westech Engineering, Inc.	3 ft Diameter 5 ft Long Drum	1	1 Continuous	30
Ash Conveyor	Ash From Vacuum Filter To Storage	Serpentix Conveyor Corp. Buck-El	50 ft Long	1	Continuous	15
Ash Storage	Maximum of Three Days Storage	N.A.	82,500 gallons	1	Continuous	N.A.
Sludge Management Building	Building For All Equipment	N.A.	18,300 sf	1	N.A.	N.A.
Sludge Storage Pole Barn	Five Days' Sludge Storage	N.A.	200 ft l x 35 ft w	1	Intermittent	N.A.
Front End Loader	On-Site Sludge Transport	Catapiller CAT 910F	16,500 lb, 1-3/4 CY Bucket	1	Intermittent	N.A.
Truck Weigh Station	Large Truck Scale	Syracuse Scale	N.A.	1	N.A.	N.A.
Superheaters (GFSH 1&2)	Natural Gas-Fired Superheat Steam Produced by HRSGs	Moorhead Machinery & Boiler Co.	14.2 ft l x 8 ft w x 7.5 ft h each 13,000 lb	2	Continuous	N.A.
Steam Turbine/Generator Set	38,400 lb/hr, 600 psig, 700 F In 150 psig, 397 F, 1050 kW Out	Mechanical Technology, Inc.	12 ft l x 8 ft w x 8 ft h each 26,000 lb	1	Continuous	N.A.
Peaking Boiler	Natural Gas-Fired, 40,000 lb/hr, 150 psig	Cleaver Brooks	20 ft l x 10 ft w x 10 ft h	1	Intermittent	25
Excess Heat Heat Exchanger	Condense 38,400 lb/hr steam	B&G	15 ft long	2	Intermittent	N.A.
Boiler Feed Pumps	120 gpm @ 1400 TDH	Goulds Pump, Inc. Model 3310	5 ft l x 2 ft w Base	2	1 Continuous (1 Stand-By)	80
Land Acquisition	3 Acres	N.A.	N.A.	1	N.A.	N.A.

N.A. = Not Applicable

PROJECT COSTS

The costs associated with this project would include the capital costs to construct the proposed facility, the annual costs to operate and maintain the facility, and the annual revenue received from the sale of energy products and sludge tipping fees. All costs presented in this report are in fourth quarter 1993 dollars.

Table 7-2 shows the estimated total construction costs for the proposed sludge co-combustion facility. The construction cost estimates shown in Table 7-2 are based on manufacturer's data and Means 1993 Site Work Cost Data. Construction costs include the equipment costs, freight costs, labor and installation fees, and contractor overhead and profit. The construction cost estimates include the costs for all of the proposed facilities shown in figures 7-1, 7-2, and 7-3. In general, the equipment costs shown in Table 7-2 include the installed cost of process equipment. Each fluidized-bed incinerator would include: 21-foot-diameter reactors with refractory and insulation; feed system; startup system; over-temperature spray system; auxiliary fuel systems; fluidizing air blower and purge air system with associated motor drives; sand storage and feed system; heat recovery steam generator systems; venturi, separator and tray cooling systems; ash pump, ash thickener and vacuum filter system for ash dewatering; interconnecting duct and chutes; interconnecting piping and wiring; associated structural steel, platforming, stairs, and ladders; exhaust stack with continuous emission monitoring system; operational instrumentation and controls; and startup, commissioning, and performance test support. The fluidized-bed incinerators would be supplied by one manufacturer as one complete package.

Sitework includes the cost of site preparation, grading, paving, landscaping, natural gas service, electric service, fencing, excavating, dewatering, and topsoil and seeding. Yard piping and pumps includes water supply piping, wastewater piping, secondary effluent piping and pumps, and sludge piping and pumps. Piping and mechanical equipment includes steam piping, miscellaneous piping between mechanical equipment, and ancillary mechanical equipment such as flash tanks, deaerators, and condensate receivers. The feedwater system includes all of the necessary pumps and piping to the three boilers. Water treatment includes boiler make-up water supply and treatment facilities.

Table 7-2. Estimated Total Construction Costs.

ITEM	QUANTITY	UNIT COST	TOTAL COST
Live-Bottom Sludge Receiving Hoppers	4	\$127,500	\$510,000
Sludge Pump Station	LS	\$200,000	\$200,000
Relocate Existing Belt Filter Presses	2	\$10,000	\$20,000
Screw Presses	2	\$300,000	\$600,000
Sludge Conveyor Systems	LS	\$170,000	\$170,000
Fluidized-Bed Incineration System	2	\$4,567,500	\$9,135,000
Wood Storage and Feed System	LS	\$375,000	\$375,000
Ash Slurry Pumps	2	\$15,000	\$30,000
Ash Conveyor	1	\$35,000	\$35,000
Ash Storage	1	\$100,000	\$100,000
Sludge Management Building	LS	\$637,500	\$637,500
Yard Piping and Pumps	LS	\$340,000	\$340,000
Site Work	LS	\$300,000	\$300,000
Sludge Storage Pole Barn	LS	\$80,000	\$80,000
Front End Loader	1	\$85,000	\$85,000
Truck Weigh Station	1	\$50,000	\$50,000
Gas-Fired Peaking Boiler	1	\$250,000	\$250,000
Steam Turbine/Generator Set	1	\$585,000	\$585,000
Ancillary Equipment	LS	\$151,500	\$151,500
Structural Improvements	LS	113,650	113,650
Electrical Improvements	LS	88,000	\$88,000
Gas-Fired Superheaters	2	80,000	\$160,000
Excess Heat Heat Exchanger	1	\$22,000	\$22,000
Piping and Mechanical Equipment	LS	\$745,000	\$745,000
Water Treatment	LS	\$98,500	\$98,500
Subtotal:			\$14,881,150
Contingencies:			\$1,488,115
Planning & Permitting:			\$818,500
Engineering, Legal, Fiscal, & Admin:			\$1,637,000
Land Acquisition:			\$100,000
Total Capital Cost:			\$18,924,765
LS = Lump Sum			

Table 7-3 shows the estimated first-year operation and maintenance costs for the proposed facility.

Table 7-3. Estimated First-Year Operation and Maintenance Cost.	
ITEM	ESTIMATED COST
Waste Wood Chips/Pallets	\$371,425
Ash Disposal	\$386,900
Labor	\$570,000
Utility	\$814,100
Equipment Insurance	\$99,500
Testing and Monitoring	\$10,000
Chemicals	\$60,000
General Office Expense	\$10,000
General Maintenance	\$96,200
Water Supply & Wastewater Treatment	\$412,300
TOTAL:	\$2,830,425

The wood chip cost is based on a wood chip purchase price of \$20/ton, including delivery. The ash disposal cost is based on a \$10/ton ash trucking and disposal cost. Labor costs include all salaries and benefits for administrative personnel and facility staff. Utility costs were estimated based on: electric cost = \$0.0625/kWh; natural gas cost = \$0.47/therm; and No. 2 fuel oil cost = \$0.85/gallon. The utility costs shown in Table 7-3, are based on the use of wood chips as the auxiliary fuel in the incinerators. It is estimated that each incinerator would require approximately 2,120 lb/hr of wood chips to sustain combustion and to produce approximately 19,200 lb/hr of steam at 600 psig. Chemical costs includes the costs for all chemicals including coagulants for the dewatering systems. General maintenance includes the anticipated cost of maintaining all process equipment, tankage, buildings, and amenities. Water supply includes the cost to purchase water from the City of Mechanicville at a cost of \$1.52/1,000 gallons. Wastewater treatment includes the annualized capital and operating costs for the additional wastewater treatment facilities to be constructed at the County wastewater treatment plant. The analysis assumes that additional plant capacity would be constructed for approximately \$2,300,000/mgd and the wastewater treatment facilities would be operated and maintained at a cost of approximately \$150,000/year/mgd.

Table 7-4 shows the estimated first-year revenue from the sale of steam and electricity.

Table 7-4. Estimated First-Year Energy Revenue.	
ITEM	ESTIMATED REVENUE
Steam	\$2,060,000
Electricity	\$546,390
TOTAL:	\$2,606,000

The steam revenue shown in Table 7-4 is based on TAGSONS' avoided energy and water purchase costs for steam production. The facility's heat recovery steam boilers would produce a total of approximately 38,400 lb/hr of steam. A gas-fired steam boiler would supplement the heat recovery boiler systems as needed to provide all of TAGSONS' steam demand. The electric revenue is based on \$0.0625/kWh. It is assumed that the Sewer District would use all of the electricity produced.

In addition to the revenue from the sale of steam and electricity, the facility would receive revenue from sludge tipping fees. The sludge tipping fee would be based on the revenue required to support the annual debt service cost and the annual operation and maintenance costs. As a component of the sludge tipping fee, the County and Town have stated that they would assess a host fee. The exact amount of the host fee has not been determined by the County or Town. For the purpose of this feasibility study, it has been assumed that the combined County and Town host fee would be \$3.00 per dry ton of sludge accepted at the sludge co-combustion facility.

Section 8

PROJECT IMPLEMENTATION PLAN

REGULATORY REQUIREMENTS

For the Sewer District to construct, operate, and maintain the proposed sludge co-combustion facility, a number of regulatory approvals and permits would be required, including:

- Approval from the Saratoga County Sewer District No. 1 allowing the recommended improvements
- Approval from the Saratoga County Board of Supervisors allowing the recommended improvements
- Approval from the New York State Department of Audit and Control for the Sewer District's increase in facilities
- Plan approval from the NYSDEC for the construction of the proposed facility
- A Permit to Construct and eventually a Certificate to Operate from the NYSDEC in accordance with Title V of the federal Clean Air Act Amendments
- A highway work permit for the construction in the NYS Route 4 right-of-way
- A railroad crossing permit from the Delaware & Hudson Railroad Company
- A beneficial use determination permit from the NYSDEC for the disposal of ash
- A State Pollutant Discharge Elimination System (SPDES) permit modification from the NYSDEC.

ENVIRONMENTAL IMPACT ASSESSMENT

Proper planning, design, construction, and operation of the proposed co-combustion facility will be necessary to avoid potential adverse impacts to the environment and to the health, safety, and welfare of the public. Impacts may be associated with the transport of wastes to the facility, the construction and operation of the facility itself, and, finally, from the disposal of residues from the facility.

Although a comprehensive environmental impact assessment for the proposed facility is likely to be required under the State Environmental Quality Review Act (SEQRA), a preliminary assessment of potential impacts is considered at this stage of planning to identify possible concerns that could affect the outcome of the permitting process. Each of these areas of potential impact is discussed in this section of the report.

Waste Transport

Once the co-combustion facility is operational, the participating paper companies will discontinue their current sludge disposal practices and begin transporting their sludge to the County treatment plant for processing and disposal. Encore, Cottrell, International Paper, and Mohawk all now haul their sludge to off-site locations for disposal, and as a result there will be little or no change required to their on-site operations to enable them to begin transporting sludge to the County. TAGSONS, on the other hand, must either complete the installation of a proposed pretreatment facility, which will produce dewatered sludge for truck transport to the Sewer District's facilities or pump thickened sludge via a sludge forcemain directly to the proposed County co-combustion facility.

Potential impacts from transport activities are expected to include:

Air Quality. Exhaust emissions from transport vehicles may be a source of potential air emissions. Since the transport vehicles will be required to possess emission control equipment meeting government standards, the effect of vehicle emissions can be expected to be very small.

Water Quality. There will be no direct or significant impact to water quality as a result of the sludge transport operations.

Hydrology and Flooding. There will be no significant impact on hydrology and flooding as a result of the transport operations.

Traffic. Additional truck traffic to and from the County treatment plant will be generated directly by the participants as they haul their sludges to the site. An estimate of the probable daily trips to and from the site is shown in Table 8-1.

Because of the location of the various participants and the County's direct access to NYS Routes 4 and 32, this traffic will occur on roads that are already heavily utilized by trucks. A comparison of existing traffic counts and those that would occur following the facility's construction would need to be completed, but it would appear that the increase in truck traffic generated by the facility would result in only a small increase in traffic. As a result, increased traffic is not expected to be a major environmental issue.

Table 8-1. Traffic Estimate.		
PARTICIPANT	AVERAGE DAILY WASTE VOLUME	ESTIMATED MAXIMUM DAILY TRUCK TRIPS
Cottrell Paper	2.9 CY	1/DAY
Encore Paper	294 CY	10/DAY
International Paper	105 CY	4/DAY
Mohawk Paper	5.5 CY	1/DAY
TAGSONS Papers	20 CY	1/DAY
	TOTAL	17/DAY

Noise. There will be additional noise generated as a result of the increased traffic volume, but the impacts of this noise can be mitigated by exercising control over the hours of facility operation and requiring transport vehicles to have properly muffled exhaust systems. If necessary, the County may restrict transport routes to reduce the potential for truck traffic in residential areas during late night hours.

Odors. Under normal conditions, the transport of sludge to the County co-combustion facility will not result in the release of objectionable odors. Fresh processed sludge from the paper companies is relatively stable and free from odors. The use of covers on the transport vehicles could be required to mitigate the potential release of odors.

Aesthetics. Aside from the visual impact that will result from the additional truck traffic, the only potential aesthetic concern from waste transport operations will be the possible deposition of sludge along the transport routes. The potential for this to occur is greatly reduced because of the high concentration of the sludges that will be transported. Furthermore, the use of properly designed and maintained containers for the sludge will reduce the likelihood of sludge losses along the highways. Consequently, the transport of the sludge is not expected to result in unavoidable aesthetic concerns that cannot be mitigated by following sound transport practices.

Historic and Cultural. Each of the participants, with the exception of TAGSONS, which will build a pipeline for sludge transport, will utilize existing facilities to transport their sludge to the proposed County

facility. As a result, no new construction will be required for sludge transport and no impact to historic and cultural resources is expected.

Fish and Wildlife. With the exception of possible spills, there will be no impact to fish and wildlife as a direct result of transport activities. Any spills that do occur will be relatively easy to contain and clean up because of the high solids content of the sludges.

Economics. The transportation of sludge to the County co-combustion facility will result in additional transport costs for most participants, but these costs will be offset by the economic benefits of having a long-term, stable disposal alternative.

Waste Processing and Combustion

The largest potential impacts associated with the proposed co-combustion facility will result from the construction of the facility itself and its on-going operation. Impacts are expected in the following areas:

Air Quality. There is the potential for air quality to be impacted by the construction of the proposed co-combustion facility, and as a result of its subsequent operation. Short-term impacts during construction could result from dust and vehicle emissions, but there are none that cannot be mitigated by the use of proper construction practices. For example, dust from construction activities can be controlled by applying water and calcium chloride to areas of exposed soil.

Long-term concern about the possible adverse impacts of emissions from the facility is likely to draw a great deal of public attention. However, a properly designed and operated fluidized-bed incinerator, with modern control technology, would not be expected to produce air emissions at a rate that exceeds the standards for emissions contained in federal or state air pollution control requirements.

Emissions from the proposed fluidized-bed incinerators can be determined from source (stack) testing on same or similar facilities, or from published emissions factors. Unfortunately, stack testing of the Sewer District's existing fluidized-bed incinerator, which is expected to have emissions characteristics similar to the proposed units, is not available, so published factors for similar units must be used to assess probable emissions from the proposed co-combustion facility.

The most complete data on emissions from a variety of processes is contained in AP-42, Compilation of Air Pollutant Emissions Factors, published by the USEPA. Based on the emissions factors published in this document for fluidized-bed incinerators combusting municipal sewage sludge, the expected emissions from the proposed co-combustion facility would be as shown in Table 8-2.

Table 8-2. Summary of Expected Emissions.		
POLLUTANT	EXPECTED EMISSIONS	
	UNCONTROLLED (tons/year)	AFTER SCRUBBER (tons/year)
Particulate	N.A.	148
Lead	N.A.	0.15
Sulfur Dioxide	495	99
Nitrogen Oxides	N.A.	49
Carbon Monoxide	N.A.	104
VOC-Methane	39	39
VOC-Non-methane	N.A.	N.A.
Figures are based on an average sludge input of 135.6 dry tons/day. N.A. = Not Available.		

The projected impact of these and other expected emissions is as follows:

Chlorine Emissions. While concern about possible chlorine emissions has been identified as a possible problem, it is unlikely that gaseous chlorine would be emitted from the facility. Chloride salts could be converted to HCl in an acidic solution in the presence of heat, but conversion to Cl_2 in an oxygen rich environment should not occur.

Carbon Monoxide. The projected emissions for carbon monoxide are below the attainment and reporting thresholds established by New York State and are not expected to be a problem.

Metals. Federal and state air pollution control guidelines set the maximum standards for the discharge of volatilized metals from incineration systems. Well-operated fluidized-

bed incinerators, operating at bed temperatures of approximately 1600°F, do not generally result in the volatilization and emission of significant quantities of heavy metals.

VOC and NOx. The discharge of volatile organic compounds (VOCs) and oxides of nitrogen (NOx) would be a concern since the proposed co-combustion facility is located in a moderate non-attainment area for ozone. However, since the total discharge of these compounds is below the attainment limits established in 6NYRR Part 231, the discharge of these compounds is not expected to be a major concern.

PICs. The emission of products of incomplete combustion (PICs) can result in odors and soot. The proper regulation of combustion air, in conjunction with the turbulence in the fluidized-bed incinerator, will limit the emission of PICs.

SO₂. The projected emissions for sulfur dioxide are below attainment and reporting thresholds established by New York State and are not expected to be a concern.

Particulate Emissions. The emission of particulates from the proposed co-combustion facility will be limited to 1.3 lb/ton of sludge input by 40 CFR 60.152. Based upon the emission factors in AP-42, the projected levels of particulate emissions will be above this level, but the data used in AP-42 was derived from stack testing of older facilities. New, modern venturi scrubber systems operating at a pressure drop of at least 15 inches of water are capable of meeting the federal emissions requirements for particulates and should be an adequate control technology. Stack testing of the facility would be required to determine the actual particulate emissions and supplemental control equipment (i.e., electrostatic precipitator) that would be required if the measured emissions exceeded the federal standard.

Water Quality. The operation of the proposed co-combustion facility will result in the production of additional wastewater that must be treated and discharged to the Hudson River. The Hudson River has a high assimilative capacity for the conventional pollutants that may be expected in the treated discharge and as a result, no significant impact to the water quality is expected. The discharge of additional treated wastewater from the co-combustion facility would also be reviewed by the NYSDEC during the SPDES permit modification process and limits would be established in the permit to prevent the degradation of the river.

Hydrology and Flooding. There will be no known impacts to hydrology or flooding as a result of the construction of the proposed co-combustion facility.

Traffic. Some unavoidable traffic impacts will result from the construction of the co-combustion facility, but these impacts will be short-term and will be limited to the facility's construction. Some additional traffic will be generated by new employees who would be hired to staff the proposed co-combustion facility; however, the additional traffic volume generated by these employees will not be significant.

Noise. Proper sound deadening construction and control over the site operations will limit the noise from the proposed facility to levels comparable to those at the Sewer District's existing wastewater treatment plant. The fluidizing-air blowers, which could be a source of significant noise, will be installed in areas equipped with sound deadening panels and baffled walls.

Odors. Careful design and proper operating procedures can be employed to ensure that no objectional odors are released from the proposed co-combustion facility during normal operations. However, odors could result from the extended outside storage of paper mill sludge or from plant equipment failure. Special design considerations could mitigate potential odors. For example, air within the sludge holding area could be drawn into the fluidized-bed incinerators.

Aesthetics. The proposed co-combustion facility would be constructed adjacent to the existing wastewater treatment plant in an area that is already heavily industrialized. The facility would have a visible plume that could have an impact on aesthetics. However, the plume would be similar in appearance to the Sewer District's existing plume which would no longer be present as a result of the consolidation of sludge incineration at the proposed facility. Thus, it is believed that the proposed facility will not adversely affect the visual characteristics of the area.

Historic and Cultural Resources. The construction of the proposed co-combustion facility will require the ir retrievable commitment of 3 acres of land adjacent to the existing County wastewater treatment plant. This property has previously been surveyed for possible impacts to historic and cultural resources and no sites of concern have been identified. As a result, the construction of the co-combustion facility is not likely to have an adverse impact on the historic and cultural resources.

Fish and Wildlife. Both short-term and long-term impacts to fish and wildlife could occur as a result of the construction of the proposed co-combustion facility. In the short-term, site clearing and earthwork

during construction of the facility could potentially generate erosion, which may adversely impact fish and wildlife. In the long-term, the facility will result in greater discharges of treated wastewater to the Hudson River. However, both the short-term and long-term impacts can be mitigated by the proper design and construction of the proposed facility.

Economics. The sludge disposal costs at the proposed co-combustion facility will be competitive with alternative disposal options; however, for most participants the costs will be higher than existing disposal costs. This is true because many of the participants are currently disposing of their sludge in unpermitted facilities, which are scheduled to close. Once these facilities are closed, the County will be able to provide an environmentally sound sludge disposal alternative that is equal to or less than the cost of disposal at other approved facilities.

Residuals Disposal.

The principal residual from the proposed co-combustion facility will be the ash produced by the fluidized-bed incinerators. Based on the projected sludge quantities and characteristics, approximately 116 dry tons per day of ash will be produced by the facility. This ash will be loaded into roll-off containers and hauled off-site daily.

Air Quality. Ash is an inert material and its intended beneficial use will not impact air quality.

Water Quality. Although the incinerator ash will be organically stable, it will contain accumulated metals which may be leached from the ash. However, beneficially using the ash as a building material additive or as an interim cover material at landfills are uses that would mitigate potential problems with metals leaching.

Hydrology and Flooding. Transporting the ash to the proposed County landfill and then mixing it with soil to produce an interim barrier layer is not expected to have any direct or indirect impacts on hydrology or flooding.

Traffic. Ash transport will require an average of five vehicle trips per day, an amount that will only be a small addition to the traffic to and from the landfill for normal solid waste disposal activities. It may also be possible to use vehicles from Encore to transport the ash on their return trips, reducing the net vehicle traffic produced by the facility.

Noise. Vehicle traffic generated as a result of transporting ash will produce minimal noise impacts. Traffic is expected to occur during daylight hours, when truck traffic is at its highest levels. In addition, properly muffled vehicles can be used to avoid adverse noise impacts.

Odors. The ash from the co-combustion process will be an organically stable material with little potential to generate odors. Proper storage and handling practices and frequent removal of the ash will eliminate the potential for odor problems.

Aesthetics. Ash handling and disposal activities can be controlled to mitigate any potential aesthetic concerns.

Historic and Cultural Resources. No impacts to historic or cultural resources are expected.

Fish and Wildlife. No impacts to fish and wildlife are expected.

Economics. Beneficially using the ash produced at the proposed co-combustion facility as an amendment to produce an interim barrier layer at landfills will have positive economic benefits for the Sewer District and the landfill. The Sewer District will realize a benefit by having an economic and safe disposal option and the landfill will be able to reduce the costs required to purchase interim cover material.

Overall Impact Assessment

It is clear from the impact assessment made in this section that the construction of the proposed co-combustion facility will have positive and negative impacts. However, there are no known adverse impacts that have been identified in this analysis that can not be mitigated by proper and careful design, construction, and operating practices. These practices will need to be more fully assessed and addressed in a full environmental assessment for the project.

FINANCING OPTIONS

There are a variety of financing options available for the proposed sludge co-combustion facility. In general, publicly-owned facilities are financed from public sources such as general obligation bonds and municipal revenue bonds. Privately-owned facilities are most often financed using industrial development bonds, private equity investments, and other traditional sources. The project could be financed by public sources, private sources, or a combination of public and private financing. Typically, municipal-related facilities are financed exclusively with municipal debt. However, the financing implementation and structure may involve a sharing of risks between the public and private participants. Financing options for the proposed sludge co-combustion facility include: the Saratoga County Sewer District No. 1, the New York State Water Pollution Revolving Loan Fund Program, the Saratoga County Industrial Development Agency, the Energy Authority, and private financing. Each of these financing options is described below.

Sewer District Financing

The Sewer District could issue general obligation bonds or revenue bonds to finance the co-combustion facility. General obligation bonds are low-interest, tax-free bonds available to governments to finance public improvement projects. The bonds are constrained by debt ceilings and they require a public referendum. The bonds obligate the issuing municipality to use the full faith and credit of its taxing power to ensure proper payment of the project debt service. Because of the unconditional nature of the municipality's obligation, general obligation bonds tend to have a lower interest rate than other forms of debt. The issuing municipality's general credit rating affects the marketability and interest rates of the bonds.

Municipal revenue bonds are tax-exempt obligations with the debt service paid solely from the revenues derived from operating the facilities acquired or constructed with the bond proceeds. Municipal revenue bonds differ from general obligation bonds in that they are not secured by a pledge of the issuer's taxing power, they are not constrained by the municipality's statutory debt limitations, and they do not require voter approval. The determination of interest rate is a complex process that involves a review of the project's economic feasibility by a rating agency. To protect against the potential of unforeseen revenue shortfalls, these bond issues normally require the capitalization of a debt service reserve fund.

Tax-exempt financing for the proposed improvements would be controlled by the provisions of the Local Finance Law. Table 8-3 shows a schedule of the estimated annual debt service payments for a general

obligation bond issuance of \$18,924,800, based on the 50%-rule of bond repayment and a 20-year bond term at an interest rate of 7.0%.

Table 8-3. Debt Service Schedule.	
YEAR	ANNUAL DEBT SERVICE PAYMENT
1995	\$2,081,728
1996	2,028,739
1997	1,975,749
1998	1,922,760
1999	1,869,770
2000	1,816,781
2001	1,763,791
2002	1,710,802
2003	1,657,812
2004	1,604,823
2005	1,930,330
2006	1,850,845
2007	1,771,361
2008	1,691,877
2009	1,612,393
2010	1,532,909
2011	1,453,425
2012	1,373,940
2013	1,294,456
2014	1,214,972

The 50%-rule of bond repayment regulates the maximum and minimum principal payments in each year of a bond term, and generally results in a payment schedule that is higher in the initial years than in the later years. This payment structure has the effect of reducing the viability of projects that depend on growth to support costs. As can be seen from Table 8-3, the highest annual principal and interest payment would be in the first year and would be \$2,081,728. The lowest annual payment would be in the last year and would be \$1,214,972. The average annual payment over the 20-year period would be approximately \$1,707,960.

New York State Water Pollution Revolving Loan Fund Program

The NYS Environmental Facilities Corporation (EFC) administers the New York State Revolving Fund (SRF) program. This program provides financial assistance in the form of short-term and long-term loans to communities in New York State for water pollution control projects. In the first 3 years of its existence,

the SRF has financed loans totaling \$1.3 billion for 130 water pollution control projects throughout New York State. Available loans from the EFC include 0%-interest, short-term financing for design and construction activities (up to 2-year term) and low-interest, long-term (20-year) financing. In June 1992, state legislation was enacted to temporarily increase the interest rate subsidy on SRF loans from a one-third reduction to a 50% reduction in the interest rate. Based on the security structure behind the SRF bonds, they are consistently highly rated by municipal bond rating services, yielding favorable interest rates. The current long-term financing interest rate is approximately 2.5 to 3.0%, but the interest rates are scheduled to increase in 1995, when the reduced rate subsidy program is due to expire. Table 8-4 shows the annual schedule of payments for a bond issuance of \$18,924,800, based on the 50%-rule of bond repayment and a 20-year bond term at an interest rate of 3.5%.

Table 8-4. Debt Service Schedule.	
YEAR	ANNUAL DEBT SERVICE PAYMENT
1995	\$1,419,360
1996	1,392,865
1997	1,366,371
1998	1,339,876
1999	1,313,381
2000	1,286,886
2001	1,260,392
2002	1,233,897
2003	1,207,402
2004	1,180,908
2005	1,532,909
2006	1,493,167
2007	1,453,425
2008	1,413,683
2009	1,373,940
2010	1,334,198
2011	1,294,456
2012	1,254,714
2013	1,214,972
2014	1,175,230

As can be seen from Table 8-4, the highest annual principal and interest payment would be in the first year and would be \$1,419,360. The lowest annual payment would be in the last year and would be \$1,175,230. The average annual payment over the 20-year period would be approximately \$1,327,100. Based on comparing the annual debt service costs shown in Table 8-3 with the costs shown in Table 8-4, the SRF

loan would result in an average annual savings of approximately \$380,860 because of the SRF loan's lower interest rate

Saratoga County Industrial Development Agency Financing

The Industrial Development Agency Act (General Municipal Law, Article 18-A) authorizes and sets forth regulations for the establishment, by a special act of the legislature, of industrial development agencies (IDAs). The Saratoga County IDA is a corporate governmental agency constituting a public benefit corporation. The purposes of the IDA are designed by the statute that gives the IDA authorization for the acquisition of real and personal property for corporate purposes, and the development of contracts with any public or private person, firm, partnership, or corporation. The agency is further empowered to acquire, construct, reconstruct, lease, improve, maintain, equip, or furnish projects, as well as to issue bonds and notes. Such bonds and notes are obligations of the agency, and neither the State nor the municipality is liable for their payment.

Industrial development bonds are a specific type of municipal revenue bond that are available from a program administered by the New York State Commerce Department. These bonds are long-term, tax-exempt bonds issued by state-designated public benefit corporations to provide financing to projects that foster industrial or economic development. Industrial development bonds have successfully been used in the past for financing projects; however, the Federal Deficit Reduction Act of 1984 has reduced the advantages of this type of financing. The Act places a limitation on the volume of annual industrial development bonds in each state, and New York State has placed a cap on the total bond amount that County IDAs can issue in a given year. Another impact of this Act on industrial development bonds is the restriction on tax-exempt financing of non-qualifying costs. Thus, a portion of a facility's expenses may have to be financed with taxable or private equity.

The Energy Authority

The Energy Authority is a public benefit corporation that sponsors energy research, development, and demonstration programs which promote safe and economical energy production and conservation technologies in New York State. The Energy Authority issues tax-exempt bonds and notes for energy-related projects. The Energy Authority currently manages two facilities in New York State. The Energy Authority currently does not provide any interest rate subsidies; therefore, the debt service schedule would be similar to the schedule shown in Table 8-3.

Private Financing

Private funds could be used to finance the proposed co-combustion facility. Under private financing, the developer could obtain the required capital from reserves, debt or equity issues, and/or bank loans. Disadvantages of private financing include: the facility would be subject to real estate taxes; the private investor would not be able to secure tax-exempt debt, and the cost of issuance could be higher based on the private investor's credit rating. The cost of capital is typically higher with private financing, but this cost can be offset by investment tax credits and depreciation deductions that are available to the private sector.

Recommended Financing Option

Based on a review of the various financing options available, it is recommended that the project be financed using a long-term, low-interest rate, SRF loan. The interest rate subsidies on an SRF loan would result in the lowest annual debt service cost for the facility.

For a project to be considered for SRF funding, it must appear on the State Project Priority List (PPL) in the SRF Intended Use Plan (IUP). Each year, the IUP is prepared by the EFC to identify projects that are expected to be ready for financing in the current fiscal year, or future fiscal years. To be listed in the current fiscal year, certain minimum requirements must be satisfied. These requirements include: a commitment to a specific project schedule, the availability of a project engineering report, and compliance with the State Environmental Review Process (SERP). A project must be on the IUP to be able to secure final loan funding. The IUP is generally finalized in the fall of each year.

SLUDGE TIPPING FEES

The annual costs associated with the facility would include the expenses for the annual debt service payment and the operation and maintenance of the facility, the revenues from the sale of energy products, and the revenues from sludge tipping fees. Based on the bond repayment schedule shown in Table 8-4, the estimated first-year operation and maintenance costs shown in Table 7-3, and the estimated first-year energy revenues shown in Table 7-4, the sludge tipping fees would need to generate a revenue of approximately \$1,643,800, plus the required host fees, in order for the project to break-even. Based on an estimated 135.6 dry tons of sludge/day, and an assumed total host fee of \$3.00/dry ton of sludge received at the facility, the resulting sludge tipping fee would be approximately \$36.20/dry ton to break-even. In September 1993, each participating paper company responded to a survey requesting each company to state

the maximum sludge tipping fee that they would be willing to pay. Table 8-5 is a summary of the survey response.

Table 8-5. Summary of Survey Responses.	
PAPER COMPANY	MAXIMUM SLUDGE TIPPING FEE (\$/dry ton)
Cottrell Paper Company	\$60
Encore Paper Company	\$20
International Paper Company	\$23
Mohawk Paper Mills	\$50
TAGSONS Papers	\$40

Based on the tipping fees shown in Table 8-5, the proposed sludge tipping fee of \$36.20/dry ton exceeds the maximum fee that Encore Paper Company and International Paper Company indicated would be acceptable. Based on the survey responses, the proposed tipping fee would be acceptable to Cottrell Paper Company, Mohawk Paper Mills, and TAGSONS Papers.

SENSITIVITY ANALYSIS

There are several sensitive factors that could affect the economic feasibility of the proposed sludge co-combustion facility. Specifically, changes in sludge tipping fee apportionment, sludge Btu values, ash disposal costs, and steam revenues could affect the feasibility of this project. The impact of changes in these factors on the required sludge tipping fee is as follows:

Sludge Tipping Fee Apportionment

The sludge tipping fee of \$36.20/dry ton is based on dividing the total revenue required from sludge tipping fees by the projected total tons per day of dry solids to be delivered by the participants. The sludge tipping fee could also be calculated by taking into account such factors as the sludge total solids content and sludge Btu values. As shown in Table 3-1, each participant's sludge has different characteristics. Table 8-6 shows the impact of changes in the calculation of the sludge tipping fees on the resulting annual sludge tipping fees for each participant.

The column in Table 8-6 identified as Maximum Annual Sludge Tipping Fee was calculated by multiplying the sludge tipping fees shown in Table 8-5 by each participant's proposed annual quantity of dry solids. The column in Table 8-6 identified as 100% Dry Solids Quantity is the estimated annual sludge tipping fee revenue calculated on the basis of dry solids.

The estimated annual costs shown in the column identified as Total Solids Content in Table 8-6 were calculated by assessing sludge dewatering costs to each participant based on the total solids content of their sludge. Thus, the capital costs and annual operation and maintenance costs for the belt filter presses were apportioned to TAGSONS and the Sewer District, based on their quantity of solids. The capital costs and annual operation and maintenance costs for the screw presses were apportioned to Cottrell, Encore, TAGSONS, and the Sewer District, based on their quantities of solids. Since Mohawk and IP's sludges would not require further dewatering at the co-combustion facility, these companies would not contribute to the costs associated with the sludge dewatering facilities.

The estimated annual costs shown in the column identified as sludge Btu value in Table 8-6 were calculated by assessing auxiliary fuel costs to each participant based on the Btu value of each participant's sludge. Thus, sludges with a high Btu value, including Cottrell, TAGSONS, and the Sewer District, were given credits for their high Btu-value sludge, while the remaining participants, with lower Btu-value sludge, would pay for the auxiliary fuel in proportion to the total Btu content of their sludge. In all columns, the sum of the annual sludge tipping fee revenues is approximately \$1,792,300, which is the annual revenue required to break-even.

Sludge Btu Values

Changes in the sludge Btu value would also have an impact on sludge tipping fees. The sludge tipping fee would vary inversely with the sludge Btu value. If the sludge Btu value were lower, then more auxiliary fuel would be required to sustain combustion and the facility would have a higher operating cost. If the sludge Btu value were higher, then less auxiliary fuel would be required and the facility would have a lower operating cost.

Table 8-6. Sensitivity Analysis of Required Sludge Tipping Fee Revenue Versus Tipping Fee Cost Apportionment.						
PARTICIPANT	SURVEY RESPONSE			ANNUAL SLUDGE TIPPING FEE		
	Maximum Sludge Tipping Fee	Dry Solids Quantity (ton/day)	Maximum Annual Sludge Tipping Fee	100% Dry Solids Quantity	Total Solids Content	Solids Btu Value
Cottrell Paper Company	\$60	0.6	\$13,140	\$7,930	\$7,981	\$6,287
Encore Paper Company	\$20	75	\$547,500	\$991,297	\$963,962	\$1,031,855
International Paper Company	\$23	40	\$335,800	\$528,692	\$465,045	\$536,833
Mohawk Paper Mills	\$50	2	\$36,500	\$26,435	\$23,304	\$28,683
TAGSONS Papers	\$40	10	\$146,000	\$132,173	\$186,540	\$83,825
Sewer District No. 1		8		\$105,738	\$145,431	\$104,782
TOTAL:		135.6		\$1,792,265	\$1,792,265	\$1,792,265

Ash Disposal Costs

The economic analysis assumes that the Sewer District would obtain a beneficial use determination permit for the ash produced by the proposed sludge co-combustion facility, and therefore it would cost \$10/ton to transport and dispose of the ash. Table 8-7 shows the total sludge tipping fee revenue and resultant sludge tipping fee required for various ash disposal costs.

Table 8-7. Sludge Tipping Fee Versus Ash Disposal Cost.	
ASH DISPOSAL COST	SLUDGE TIPPING FEE (\$/dry ton)
\$0/ton	\$28.39
\$10/ton	\$36.20
\$20/ton	\$44.03
\$30/ton	\$51.85
\$40/ton	\$59.66
\$50/ton	\$67.48

As can be seen from Table 8-7, if the ash disposal cost were to increase, then the sludge tipping fee would increase proportionately.

Steam Revenues

It is proposed that all of the steam produced by the co-combustion facility would be sold to TAGSONS. The estimated annual steam revenue is \$2,060,000. Table 8-8 shows the impact of changes in the annual steam revenue on each participant's annual sludge tipping fee.

As can be seen from the estimated annual costs shown in Table 8-8, changes in the annual steam revenue would significantly affect each participant's annual sludge tipping fee.

**Table 8-8. Sensitivity Analysis of Required Sludge Tipping Fee Revenue
Versus Steam Revenues.**

PARTICIPANT	ANNUAL SLUDGE TIPPING FEE				
	\$2,060,000 STEAM REVENUE	\$1,500,000 STEAM REVENUE	\$1,000,000 STEAM REVENUE	\$500,000 STEAM REVENUE	\$0 STEAM REVENUE
Cottrell Paper Company	\$7,930	\$10,408	\$12,621	\$14,833	\$17,045
Encore Paper Company	\$991,297	\$1,301,031	\$1,577,580	\$1,854,129	\$2,130,677
International Paper Company	\$528,692	\$693,883	\$841,376	\$988,869	\$1,136,361
Mohawk Paper Mills	\$26,435	\$34,694	\$42,069	\$49,443	\$56,818
TAGSONS Papers	\$132,173	\$138,777	\$168,275	\$197,774	\$227,272
Sewer District No. 1	\$105,738	\$173,471	\$210,344	\$247,217	\$284,090
TOTAL:	\$1,792,265	\$2,352,264	\$2,852,264	\$3,352,264	\$3,852,264

IMPLEMENTATION SCHEDULE

Table 8-9 shows the proposed implementation schedule for the sludge co-combustion facility. The most critical item in the schedule would be obtaining the necessary commitments from each of the participants. It is necessary that the Sewer District obtain written commitments from each participant, stating that each participant agrees to the proposed partnership. A legal contract would be required that would detail such items as a long-term commitment to deliver an adequate quantity and quality of sludge to the Sewer District, required sludge tipping fees including host fees, delivery requirements, alternative arrangements should the co-combustion facility be shutdown for an extended period of time, and risk sharing agreements. Assuming that the Sewer District receives written commitments from each of the participants, the project could move forward through the permitting and planning stages. It is anticipated that it would take approximately 1 year for the permitting and planning stage. Once all of the approvals are received, it is anticipated that the contracts could be bid, awarded, and constructed within 1 year.

Table 8-9. Proposed Project Implementation Schedule.	
ACTIVITY	DATE
Complete Feasibility Study Stage	September 1994
Decision is Made by the Sewer District & All Participants to Proceed Forward with Project	October 1994
Agreements Are Reached with All Participants	November 1994
Initiate Planning Stage	December 1994
Apply to the New York State EFC to Get on the State Project Priority List	December 1994
Meetings with Involved Regulatory Agencies	On-Going
Initiate SEQRA/SERP Reviews	January 1995
Prepare Basis of Design Report	February 1995
Apply to the New York State EFC to Get on the Intended Use Plan	December 1995
Initiate Land Acquisition	December 1995
Preliminary Agreements Are Reached with Waste Wood Processors	January 1996
Final Design Plans and Specifications Are Prepared	May 1996
Obtain All Required Regulatory Permits and Approvals	July 1996
Advertise for Bids	August 1996
Open Bids	September 1996
Award Contracts	October 1996
Begin Construction	November 1996
Substantial Completion	June 1997
Final Completion	August 1997

Section 9

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Based on the results of the study, it was determined that it would be technically feasible to co-combust municipal sewage sludge and paper mill sludge at the Saratoga County Sewer District No. 1's wastewater treatment plant. The economic feasibility of this project is based on the cost that each participant would pay for sludge disposal at the proposed co-combustion facility. Based on each participant's proposed quantity of dry solids and a continuous demand for the energy products produced by the co-combustion facility, the sludge tipping fee would be approximately \$36.20/dry ton. Under worse case conditions, with no sale of steam, the sludge tipping fee would be approximately \$77.80/dry ton.

Correspondence with each of the participating paper companies indicates that a \$36.20/dry ton tipping fee would be acceptable to Cottrell Paper Company, Mohawk Paper Mills, and TAGSONS Papers. However, this tipping fee would not be acceptable to Encore Paper Company and International Paper Company. These two companies stated that they would pay a maximum sludge tipping fee of approximately \$20/dry ton and \$23/dry ton, respectively. Based on the sensitivity analysis, it is not likely that the sludge tipping fee could be reduced to \$20/dry ton. As Encore Paper Company and the International Paper Company would be contributing the largest quantities of sludge, if these companies decided not to proceed with the project, then the sludge tipping fees would increase and the project's economic viability would be reduced.

The proposed co-combustion facility would provide a long-term solution to the sludge disposal needs of each participant. Currently, there are few long-term sludge disposal options available to the participants. Each participant's evaluation of the feasibility of this project should include the potential long-term benefits that could be obtained from the sludge co-combustion facility.

RECOMMENDATIONS

Based on the results of this report, it is recommended that each participant consider the following:

- Each participant should review the information presented in this report and decide whether or not they want to move forward with this project
- The Sewer District should consider investigating beneficial use options for the ash produced by its existing fluidized-bed incinerator

- Each participant should develop a list of provisions that would be required for the facility's contracts. It is anticipated that the contracts would detail such items as a long-term commitment to deliver an adequate quantity and quality of sludge to the co-combustion facility, required sludge tipping fees including associated host fees, delivery requirements, alternative arrangements should the co-combustion facility be shutdown for an extended period of time, and risk sharing agreements
- The exact amount of the Sewer District and Town of Halfmoon's host fee should be determined
- Discussions with TAGSONS Papers, Inc. should begin to reach an agreement for the sale of steam
- Contact should be made with the EFC regarding potential SRF financing for the proposed project.

APPENDIX A

STATEMENT OF INTEREST FORMS

STATEMENT OF INTEREST

I, Theodore J. Harrington, as authorized representative of the firm
f Cottrell Paper Co., Inc., represent as follows:

(Check only one box)

☒] That I am interested in participating in a cooperative study of the economic feasibility of disposing of paper sludge residues at the Saratoga County WWTP. The average daily quantity of paper mill residues from our operation which would be handled by the proposed County paper sludge management facility is 1/2 tons/day.

☐] That I am not interested in participating in a cooperative study of the economic feasibility of disposing of paper sludge residues in the Saratoga County WWTP.

Theodore J. Harrington
Signature

2-6-92
Date

Note: If you checked the first box above, you must supply your estimated waste solids production on a dry weight basis, in the space provided above.

Post-It™ brand fax transmittal memo 7671		# of pages	1
To	Edw J. Hogan	From	M. Barile
Co.		Co.	2-4-92
Dept.	Legal	Phone #	
Fax #	383-5347	Fax #	664-6280

STATEMENT OF INTEREST

I, Patrick J. Burke, as authorized representative of the firm
of James River Corporation, represent as follows:

(Check only one box)

- ☒ That I am interested in participating in a cooperative study of the economic feasibility of disposing of paper sludge residues at the Saratoga County WWTP. The average daily quantity of paper mill residues from our operation which would be handled by the proposed County paper sludge management facility is 75 tons/day.
- ☐ That I am not interested in participating in a cooperative study of the economic feasibility of disposing of paper sludge residues in the Saratoga County WWTP.

Signature

January 30, 1992
Date

Note: If you checked the first box above, you must supply your estimated
ste solids production on a dry weight basis, in the space provided above.

Post-It™ brand fax transmittal memo 7671		# of pages ▶ /
To <u>ED GROGAN</u>	From <u>MARILYN</u>	
Co.	Co. <u>SCSD #1</u>	
Dept.	Phone # <u>664-7396</u>	
Fax # <u>383-5347</u>	Fax # <u>664-6280</u>	

STATEMENT OF I

I, STUART FIELD, as authorized representative of the firm
of INTERNATIONAL PAPER, represent as follows:

(Check only one box)

☒ That I am interested in participating in a cooperative study of the economic feasibility of disposing of paper sludge residues at the Saratoga County WWTP. The average daily quantity of paper mill residues from our operation which would be handled by the proposed County paper sludge management facility is < 20 tons/day.

☐ That I am not interested in participating in a cooperative study of the economic feasibility of disposing of paper sludge residues in the Saratoga County WWTP.

*I WILL NOT BE ABLE TO COMMIT TO A
CONTRACT PRIOR TO KNOWING OUR SHARE OF THE COST
OF THE STUDY*

Stuart Field
Signature

JAN 27, 1992
Date

Note: If you checked the first box above, you must supply your estimated solids production on a dry weight basis, in the space provided above.

JAN-30-92 THU 11:47

MOHAWK PAPER

Post-It™ brand fax transmittal memo 7671

of pages 1

To <u>E. Grogan</u>	From <u>M. Park</u>
Co.	Co. <u>SCSD#1</u>
Dept.	Phone # <u>664-7396</u>
Fax # <u>383-5347</u>	Fax # <u>664-6280</u>

STATEMENT OF INTEREST

I, GEORGE W. MILNER, as authorized representative of the firm
of MOHAWK PAPER MILLS, INC., represent as follows:

(Check only one box)

☒ That I am interested in participating in a cooperative study of the economic feasibility of disposing of paper sludge residues at the Saratoga County WWTP. The average daily quantity of paper mill residues from our operation which would be handled by the proposed County paper sludge management facility is 200 tons/day.

☐ That I am not interested in participating in a cooperative study of the economic feasibility of disposing of paper sludge residues in the Saratoga County WWTP.

George W. Milner
Signature

1/29/92
Date

Note: If you checked the first box above, you must supply your estimated
ste solids production on a dry weight basis, in the space provided above.

APPENDIX B
COMPLETED QUESTIONNAIRES

SARATOGA COUNTY SEWER DISTRICT NO. 1
CO-COMBUSTION STUDY QUESTIONNAIRE

THIS QUESTIONNAIRE WAS PREPARED BY CLOUGH, HARBOUR AND ASSOCIATES AS PART OF THE ENGINEERING SERVICES FOR THE SARATOGA COUNTY SEWER DISTRICT #1 CO-COMBUSTION STUDY. IN ORDER FOR THE STUDY TO CONTINUE AS SCHEDULED, THE INFORMATION REQUESTED HEREIN IS REQUIRED.

PLEASE BE AS ACCURATE AND CONCISE AS POSSIBLE WHEN COMPLETING THE QUESTIONNAIRE, AS THE INFORMATION GATHERED HERE WILL BE THE BASIS FOR ANY RECOMMENDATIONS TO BE MADE AT A LATER DATE.

IF ANY INFORMATION IS CONFIDENTIAL IN NATURE AND SHOULD NOT BE RELEASED WITHOUT CONSULTATION, PLEASE INDICATE SO.

YOUR COOPERATION IS GREATLY APPRECIATED.

RECEIVED
NOV 09 1992
CLOUGH, HARBOUR
& ASSOCIATES

A. GENERAL INFORMATION

1. Name of Paper Company: Cottrell Paper Co., Inc.

2. Contact Person at Facility: Ted Harrington

B. PAPER PRODUCTION

1. What are the average operating hours of the mill? 24 hrs./day,
5 days/wk., and 50 wks./yr.
2. How many, and what types of paper grades are produced at the mill? 100% cotton
Class A Electrical Insulating Paper, 100% Brown Kraft Class A 100% bleached
Kraft
3. What is the average daily paper production, in tons/day, at the mill? 6 tons

4. What is the maximum daily paper production, in tons/day, at the mill? 9 tons

5. Please list all existing environmental permits for your mill (for examples, SPDES,
NPDES, Sewer Users' Permit, Air Permit, etc.). SPDES, Air Permit

Please attach a copy of all existing environmental permits.

6. Is there any future expansion planned for the paper mill? Yes
If so, when? within a decade
Please give a description of the proposed expansion and explain the impacts that it
will have on the current paper and sludge production. expand pulping capacity
by 100%

C. ON-SITE WASTEWATER TREATMENT FACILITIES

1. Are there any wastewater treatment facilities at your mill? Yes
If not, where is the untreated wastewater discharged? _____

2. Please list and give a description of each of the on-site wastewater treatment facilities. Clarifier pit 6 hour retention

Please attach a process flow sketch of the facilities.

3. What is the average daily and maximum daily wastewater flow through the treatment facilities? 350 K - 500 K

4. What effect does the variation in paper grade have on wastewater treatment? _____
No blow down with Kraft

5. Please list the different plant operations and show each operation's contribution to wastewater flow:

<u>Operation</u>	<u>Average Flow</u>
cooking rags	500 G
cleaning	120 G
beater wash	54,000 G
white water	?
toranado	100,000 G

6. What are the current annual operation and maintenance costs for the wastewater treatment facility? 24,000 O&M 3,000 Polymer 14,000 Alum

Attach a detailed breakdown of operation and maintenance costs, such as labor, materials, electricity, etc.

7. Where is the treated effluent discharged? Kaydedrossaross Creek

8. Are you now required by any federal, state, or local authority to meet any implementation schedule for the construction, upgrading, or operation of wastewater treatment equipment or practices, or any other environmental programs which may affect the discharges? No If yes, please explain. _____

9. Please attach a copy of required effluent parameters and any operating records which exist for the wastewater treatment facilities for the past 2 years.

D. SLUDGE PRODUCTION AND DISPOSAL FACILITIES

1. What is the average daily sludge production? 2 wet 80% water & 20% solids tons/day, 2 yd³/day.
Maximum daily sludge production? 3 tons/day, 3 yd³/day.
Minimum daily sludge production? 2 tons/day, 2 yd³/day.

Please attach any sludge production records which may exist.

2. Please list and give a description of all on-site sludge management facilities.

belt dewatering press

40X80 building with 2 inground chests

conveyour/ 5 yd dump truck

mixing tanks

Please attach a process flow sketch of these facilities.

3. What effect does the variation in paper grade have on sludge production? none
we still run belt press twice weekly

4. What analyses are performed on the sludge? heavy metals

How often are these tests performed? no set time

Please attach copies of the sludge test results for the past 2 years.

5. Please list the average and maximum quantities of the sludge for each of the parameters listed below:

	<u>Average</u>	<u>Maximum</u>
• Total Suspended Solids (TSS) (mg/l)	NA	
• Volatile Suspended Solids (VSS) (mg/l)	79.9	
• BOD ₅ (mg/l)	NA	
• Clay Content (mg/l)	NA	
• Ash Content (mg/l or %)	NA	
• pH	NA	
• BTU Value of Sludge (BTU/lb.)	NA	

6. After on-site treatment, where is the sludge disposed? Town land fill

7. What are the annual costs for the current method of sludge disposal? (Please give a detailed breakdown of costs, such as labor, trucking, tipping fees, etc.)

21,000 - tipping

12,000 - labor

7,500 - truck

5,000 - polymer

8. Is there any on-site sludge storage available? limited at present

If so, how much? 5 yd dump truck

9. Please attach a copy of any TCLP test results, and any other sludge testing results which may exist.

N.Y.S. DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF AIR

SEQNC NO: 5-R-0074
RUN DATE: 01/04/88

414200 0149 00001 W C
LOCATION FAC EP

CERTIFICATE TO OPERATE AN AIR CONTAMINATION SOURCE
STATIONARY COMBUSTION INSTALLATION UNIT
RENEWAL APPLICATION

JAN 26 1988

OWNER 1) COTTRELL PAPER CO 2) BOX 35 3) Rock City Falls (4) NY 5) 12863	FACILITY (6) COTTRELL PAPER CO (7) BOX 35 (8) ROCK CITY FALLS (9) 12863 (10) REP: Ted HARRINGTON	(11) CONFIDENTIAL STATUS NON-CONFIDENTIAL (12) APPLICATION STATUS IN COMPLIANCE DATE OF LAST CHANGE 05/26/84 PRIOR CO ISSUE DATE 04/24/83 PRIOR CO EXPIRATION DATE 04/24/88
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PAGE 3
CONTINUED FROM PREVIOUS PAGE

MISSION POINT 00001

(41)UTM-E: 588.2 KM. (42)STACK HEIGHT: 64 FT. (43)EXIT VELOCITY: 11.50 FT/SEC (44)SIC: 2611 (45)AGENCY-CODE-1:
(46)UTM-N: 768.1 KM. (47)HT ABV STRUC: 350 FT. (48)EXIT FLOW: 6021.00 ACFM (49)CO FEE: \$30.00 (50)AGENCY-CODE-2:
(51)GRND ELEV: 450 FT. (52)STK DIAM: 40 IN. (53)EXIT TEMP: 350 DEGR F (54)CO CONDITIONS: 1 3
(55)HEAT INPUT: 17.2 MILLIONS BTU/HR (56)CONTINUOUS MONITORS: (F)OTHER
(57)TYPE: (58)MFG: (59)HEAT INPUT: 17.20 MILLIONS BTU/HR
(60)AIR INTAKE: (61)SOURCE CODE: A
(62)BLDG: BOILER HOUSE (63)FLOOR NAME: FIRST

IR CONTAMINANTS	CAS NUMBER	EMISSIONS				% CONTROL EFFICIENCY	HRLY ACTUAL LBS/HOUR	ANNUAL EMISSIONS (LBS/YEAR)		
		ACTUAL	UNIT	HOW DET	PERMISSIBLE			ACTUAL	10X	PERMISSIBLE
TOTAL SOLID PART	(098) NY079-00-0	(099) .9	(100) 01	(101) 05	(102) .9	(103) 0.9	(104) .9	(105) 3789	(106) 0	(107) 3789
SULFUR DIOXIDE	(108) 07446-09-5	(109) 11.75	(110) 01	(111) 05	(112) 11.75	(113)	(114) 11.75	(115) 49463	(116) 0	(117) 49463
OXIDES OF NITROGEN	(118) NY210-00-0	(119) 4.000	(120) 01	(121) 05	(122) 4.000	(123)	(124) 4.000	(125) 732.000	(126) 0	(127) 732.000

5)PRIOR COMMENTS (16)BY H POTTER (17)DATE 03/08/83 (18)CURRENT COMMENTS (19)BY Bell (20)DATE 03/15/88 (27)LAST INSPECTION DATE / /

1. NO VISIBLE EMISSIONS NOTED DURING (21)INSPECTION STATUS 5
2. NORMAL OPERATIONS. (22)DATE OF NEXT ACTION / /
3. (23)ISSUE DATE 04/25/88
4. (24)EXPIRATION DATE 04/24/93
5. (25)CO FEE 50

RM-REP'S SIGNATURE: *T.J. Harrington* DATE: 3-31-88 ISSUING OFFICER'S SIGNATURE: *Thomas W. Hall* DATE: 4-14-88

SARATOGA COUNTY SEWER DISTRICT NO. 1
CO-COMBUSTION STUDY QUESTIONNAIRE

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YOUR COOPERATION IS GREATLY APPRECIATED.

A. GENERAL INFORMATION

1. Name of Paper Company: Encore Paper Company
2. Contact Person at Facility: Barb Hemken Jeff Davis

B. PAPER PRODUCTION

1. What are the average operating hours of the mill? 24 hrs./day,
7 days/wk., and 52 wks./yr.
2. How many, and what types of paper grades are produced at the mill? TISSUE 9.5-13 #/3000 ft²
TOWELLING 25-28 #/3000 ft²
3. What is the average daily paper production, in tons/day, at the mill? 130 Tons/day
4. What is the maximum daily paper production, in tons/day, at the mill? 160 tons/day
5. Please list all existing environmental permits for your mill (for examples, SPDES, NPDES, Sewer Users' Permit, Air Permit, etc.). SPDES - NY000784

Please attach a copy of all existing environmental permits.

6. Is there any future expansion planned for the paper mill? YES
If so, when? 1993

Please give a description of the proposed expansion and explain the impacts that it will have on the current paper and sludge production. Drink capacity will be increased (20%); one paper machine will be rebuilt (additional ton/yr paper will result in additional

15 tons sludge daily (dry tons)

C. ON-SITE WASTEWATER TREATMENT FACILITIES

1. Are there any wastewater treatment facilities at your mill? yes
If not, where is the untreated wastewater discharged? _____

2. Please list and give a description of each of the on-site wastewater treatment facilities. primary clarification 75' diameter settling clarifier
aeration - app. 1,000,000 gal tank, 1600 cfm air at 30 psi
secondary clarification - 2 dissolved air flotation units
sludge dewatering - 2 Kamine Supermax belt presses

Please attach a process flow sketch of the facilities. ✓

3. What is the average daily and maximum daily wastewater flow through the treatment facilities? avg - 2.250 million gal/day
max - 2.4 million gal/day
4. What effect does the variation in paper grade have on wastewater treatment? minimal

5. Please list the different plant operations and show each operation's contribution to wastewater flow:

<u>Operation</u>	<u>Average Flow</u>
<u>deink plants (2)</u>	<u>no breakdown available</u>
<u>paper machines (3)</u>	

6. What are the current annual operation and maintenance costs for the wastewater treatment facility? labor line items: \$931,000
chemicals: \$750,000 materials: \$50,000

Attach a detailed breakdown of operation and maintenance costs, such as labor, materials, electricity, etc.

7. Where is the treated effluent discharged? Hudson River

8. Are you now required by any federal, state, or local authority to meet any implementation schedule for the construction, upgrading, or operation of wastewater treatment equipment or practices, or any other environmental programs which may affect the discharges? No If yes, please explain.

9. Please attach a copy of required effluent parameters and any operating records which exist for the wastewater treatment facilities for the past 2 years.

D. SLUDGE PRODUCTION AND DISPOSAL FACILITIES

What is the average daily sludge production? 65 tons/day, 200 yd³/day.

Maximum daily sludge production? 85 tons/day, 510 yd³/day.

Minimum daily sludge production? ^{anticipated} 40 tons/day, 240 yd³/day.

Please ^{would be 0 if operation were shut down for any reason} attach any sludge production records which may exist.

2. Please list and give a description of all on-site sludge management facilities.

primary sludge - pumped to either a storage tank where
it is mixed with process waste and secondary sludge
and then to one of two Komline Sanceren dewatering
presses or direct to the press. biological sludge
wasted from the secondary clarifiers goes to the storage
tank. sludge is dewatered to approx 30% solids
conveyed to a storage area, loaded into trucks & hauled
Please attach a process flow sketch of these facilities. to landfill.

3. What effect does the variation in paper grade have on sludge production? _____

minimal

4. What analyses are performed on the sludge? Solids content, Ash

level tested routinely. other parameters tested
infrequently as necessary

How often are these tests performed? Solids - ash - 3 times/day

Please attach copies of the sludge test results for the past 2 years.

5. Please list the average and maximum quantities of the sludge for each of the parameters listed below:

	<u>Average</u>	<u>Maximum</u>
• Total Suspended Solids (TSS) (mg/l)	<u>n/a</u>	<u>n/a</u>
• Volatile Suspended Solids (VSS) (mg/l)	<u>n/a</u>	<u>n/a</u>
• BOD ₅ (mg/l)	<u>n/a</u>	<u>n/a</u>
• Clay Content (mg/l)	<u>n/a</u>	<u>n/a</u>
• Ash Content (mg/l or %)	<u>42 %</u>	<u>50 %</u>
• pH	<u>7.0</u>	<u>n/a</u>
• BTU Value of Sludge (BTU/lb.)		

6. After on-site treatment, where is the sludge disposed? Town of Moreau
landfill

7. What are the annual costs for the current method of sludge disposal? (Please give a detailed breakdown of costs, such as labor, trucking, tipping fees, etc.)

tipping fee - \$6/yd³
trucking ~ \$1.86/yd³
1991 appr. \$1,200,000

8. Is there any on-site sludge storage available? yes
 If so, how much? max. 1.5 days

9. Please attach a copy of any TCLP test results, and any other sludge testing results which may exist.

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YOUR COOPERATION IS GREATLY APPRECIATED.

A. GENERAL INFORMATION

1. Name of Paper Company: INTERNATIONAL PAPER
CORINTH NY
2. Contact Person at Facility: STUART FIELD

B. PAPER PRODUCTION

1. What are the average operating hours of the mill? 24 hrs./day,
7 days/wk., and 51 wks./yr. (based on capital projects)
2. How many, and what types of paper grades are produced at the mill? WOOD CONTAINING & FREE SHEET COATED PUBLICATION
GRADES
3. What is the average daily paper production, in tons/day, at the mill? 525
4. What is the maximum daily paper production, in tons/day, at the mill? 680
5. Please list all existing environmental permits for your mill (for examples, SPDES, NPDES, Sewer Users' Permit, Air Permit, etc.). _____

Please attach a copy of all existing environmental permits.

6. Is there any future expansion planned for the paper mill? NO
If so, when? _____
Please give a description of the proposed expansion and explain the impacts that it
will have on the current paper and sludge production. _____

C. ON-SITE WASTEWATER TREATMENT FACILITIES

1. Are there any wastewater treatment facilities at your mill? YES
If not, where is the untreated wastewater discharged? _____

2. Please list and give a description of each of the on-site wastewater treatment facilities. _____

Please attach a process flow sketch of the facilities.

3. What is the average daily and maximum daily wastewater flow through the treatment facilities? 10.5 MILLION GALLONS AVE

12.0 MILLION GALLONS MAX

4. What effect does the variation in paper grade have on wastewater treatment? _____

NEGLECTABLE

5. Please list the different plant operations and show each operation's contribution to wastewater flow:

<u>Operation</u>	<u>Average Flow</u>

6. What are the current annual operation and maintenance costs for the wastewater treatment facility? _____

Attach a detailed breakdown of operation and maintenance costs, such as labor, materials, electricity, etc.

7. Where is the treated effluent discharged? HUDSON RIVER

8. Are you now required by any federal, state, or local authority to meet any implementation schedule for the construction, upgrading, or operation of wastewater treatment equipment or practices, or any other environmental programs which may affect the discharges? NO If yes, please explain. _____

9. Please attach a copy of required effluent parameters and any operating records which exist for the wastewater treatment facilities for the past 2 years.

D. SLUDGE PRODUCTION AND DISPOSAL FACILITIES

1. What is the average daily sludge production? 90 tons/day, 120 yd³/day.
Maximum daily sludge production? 120 tons/day, 160 yd³/day.
Minimum daily sludge production? 60 tons/day, 80 yd³/day.
Please attach any sludge production records which may exist.

2. Please list and give a description of all on-site sludge management facilities.

ON SITE SOLID WASTE LANDFILL

Please attach a process flow sketch of these facilities.

3. What effect does the variation in paper grade have on sludge production? _____

NONE
MACHINE PERFORMANCE (ie BREAKS) WILL
DIRECTLY AFFECT SLUDGE VOLUME MORE
BREAKS = MORE SLUDGE

4. What analyses are performed on the sludge? EXTENDED PARAMETER

How often are these tests performed? QUARTERLY

Please attach copies of the sludge test results for the past 2 years.

5. Please list the average and maximum quantities of the sludge for each of the parameters listed below:

	<u>Average</u>	<u>Maximum</u>
• Total Suspended Solids (TSS) (mg/l)	_____	_____
• Volatile Suspended Solids (VSS) (mg/l)	_____	_____
• BOD ₅ (mg/l)	_____	_____
• Clay Content (mg/l)	_____	_____
• Ash Content (mg/l or %)	_____	_____
• pH	_____	_____
• BTU Value of Sludge (BTU/lb.)	_____	_____

6. After on-site treatment, where is the sludge disposed? _____

SEE D-2

7. What are the annual costs for the current method of sludge disposal? (Please give a detailed breakdown of costs, such as labor, trucking, tipping fees, etc.)

8. Is there any on-site sludge storage available? SEE D-2
If so, how much? _____

9. Please attach a copy of any TCLP test results, and any other sludge testing results which may exist.

HUDSON ENVIRONMENTAL SERVICES, INC.
 248 Queensbury Ave., P.O. Box 4601
 Queensbury, New York 12804
 518/792-3863

CLIENT: International Paper

DATE SAMPLED: 02/24/92

SAMPLE DESCRIPTION: Sludge Sample

DATE SAMPLE RECD: 02/25/92

LOCATION: Corinth, NY

MATRIX: Sludge

H.E.S. #: 920225J01

TYPE SAMPLE: Grab

SAMPLER: Client

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u> *	<u>UNITS</u>	<u>TEST DATE</u>
Antimony	SW846-7040	<0.1	mg/kg	03/05/92
Arsenic	SW846-7060	0.06	mg/kg	03/12/92
Beryllium	SW846-7091	<0.02	mg/kg	03/06/92
Cadmium	SW846-7130	<0.02	mg/kg	03/18/92
Chromium, Total	SW846-7190	6.5	mg/kg	03/02/92
Copper	SW846-7210	7.9	mg/kg	03/02/92
Lead	SW846-7420	1.7	mg/kg	03/18/92
Mercury	SW846-7471	<0.1	mg/kg	03/05/92
Nickel	SW846-7520	4.2	mg/kg	03/02/92
Potassium	SW846-7610	47	mg/kg	03/02/92
Selenium	SW846-7740	<0.07	mg/kg	03/12/92
Silver	SW846-7760	<0.9	mg/kg	03/02/92
Thallium	SW846-7841	<0.04	mg/kg	03/24/92
Zinc	SW846-7750	7.5	mg/kg	03/02/92
Fluoride	SM 413	<0.1	mg/kg	03/19/92
TKN	EPA 331.3	313	mg/kg	03/18/92
Nitrogen, Nitrate	EPA 354.1	69	mg/kg	03/20/92
Nitrogen, Nitrite	EPA 354.1	<0.01	mg/kg	03/19/92
Phosphate, Total	EPA 365.2	144	mg/kg	03/24/92
pH	SW846-9045	4.4	su	03/18/92
-TVS	EPA 160.4	55	%	03/19/92
Sulfate	SM 426C	297	mg/kg	03/19/92
Chloride	EPA 325.3	13	mg/kg	03/19/92
-Total Solids	EPA 160.3	29	%	03/19/92

*Results are reported on a wet weight basis.

HUDSON ENVIRONMENTAL SERVICES, INC.
248 Queensbury Ave., P.O. Box 4601
Queensbury, New York 12804
518/792-3863

CLIENT: International Paper

DATE SAMPLED: 02/24/92

SAMPLE DESCRIPTION: Sludge Sample

DATE SAMPLE RECD: 02/25/92

LOCATION: Corinth, NY

MATRIX: Sludge

TYPE SAMPLE: Grab

H.E.S. #: 920225J01

SAMPLER: Client

PART 360 GROUND AND SURFACE WATER

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
Ph	EPA 150.1	4.4	su	03/18/92
Total Kjeldahl Nitrogen	EPA 351.3	313	mg/kg	03/18/92
Nitrate	SW846-9200	69	mg/kg	03/20/92
Sulfate	SW846-9060	297	mg/kg	03/19/92
Phenols	EPA 420.1	3.78	mg/kg	04/14/92
Chloride	EPA 325.3	13	mg/kg	03/19/92
Boron	SW846	<18	mg/kg	03/25/92
Potassium	SW846-7610	47	mg/kg	03/02/92
Sodium	SW846-7770	107	mg/kg	03/31/92
Iron	SW846-7380	9.3	mg/kg	03/31/92
Manganese	SW846-7450	6.1	mg/kg	03/31/92
Magnesium	SW846-7450	32	mg/kg	03/31/92
Aluminum	SW846-7020	28	mg/kg	03/31/92
Calcium	SW846-7140	98	mg/kg	03/02/92
Total Cyanide	SW846-9010	<10	mg/kg	03/31/92

* All results are reported on a wet weight basis.

HUDSON ENVIRONMENTAL SERVICES, INC.
248 Queensbury Ave., P.O. Box 4601
Queensbury, New York 12804
518/792-3863

CLIENT: International Paper

SAMPLE DESCRIPTION: Sludge Sample

LOCATION: Corinth, NY

H.E.S. #: 920225J01

DATE SAMPLED: 02/24/92

DATE SAMPLE RECD: 02/25/92

MATRIX: Sludge

TYPE SAMPLE: Grab

SAMPLER: Client

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
2378-TCDD	SW846-8290	<0.4	ppt	03/05/92
2378-TCDF	SW846-8290	3.0	ppt	03/05/92
Total TCDD	SW846-8290	19	ppt	03/05/92
Total TCDF	SW846-8290	9.4	ppt	03/05/92

HES

H.E.S.#: 920225J01

HUDSON ENVIRONMENTAL SERVICES, INC.

248 Queensbury Ave., P.O. Box 4601

Queensbury, New York 12804

518/792-3863

APPENDIX 33 - GROUND WATER MONITORING LIST

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
Bromodichloromethane	EPA 601	<5.0	ug/kg	03/05/92
Bromoform	EPA 601	<5.0	ug/kg	03/05/92
Bromomethane	EPA 601	<5.0	ug/kg	03/05/92
Carbon Tetrachloride	EPA 601	<5.0	ug/kg	03/05/92
Chlorobenzene	EPA 601	<5.0	ug/kg	03/05/92
Chloroethane	EPA 601	<5.0	ug/kg	03/05/92
2-Chloroethylvinyl ether	EPA 601	<5.0	ug/kg	03/05/92
Chloroform	EPA 601	<5.0	ug/kg	03/05/92
Chloromethane	EPA 601	<5.0	ug/kg	03/05/92
Dibromochloromethane	EPA 601	<5.0	ug/kg	03/05/92
1,2-Dichlorobenzene	EPA 601	<5.0	ug/kg	03/05/92
1,3-Dichlorobenzene	EPA 601	<5.0	ug/kg	03/05/92
1,4-Dichlorobenzene	EPA 601	<5.0	ug/kg	03/05/92
Dichlorodifluoromethane	EPA 601	<5.0	ug/kg	03/05/92
1,1-Dichloroethane	EPA 601	<5.0	ug/kg	03/05/92
1,2-Dichloroethane	EPA 601	<5.0	ug/kg	03/05/92
1,1-Dichloroethene	EPA 601	<5.0	ug/kg	03/05/92
trans-1,2-Dichloroethene	EPA 601	<5.0	ug/kg	03/05/92
1,2-Dichloropropane	EPA 601	<5.0	ug/kg	03/05/92
cis-1,3-Dichloropropene	EPA 601	<5.0	ug/kg	03/05/92
trans-1,3-Dichloropropene	EPA 601	<5.0	ug/kg	03/05/92
Methylene chloride	EPA 601	<5.0	ug/kg	03/05/92
1,1,2,2-Tetrachloroethane	EPA 601	<5.0	ug/kg	03/05/92
Tetrachloroethene	EPA 601	<5.0	ug/kg	03/05/92
1,1,1-Trichloroethane	EPA 601	<5.0	ug/kg	03/05/92
1,1,2-Trichloroethane	EPA 601	<5.0	ug/kg	03/05/92
Trichloroethene	EPA 601	<5.0	ug/kg	03/05/92
Trichlorofluoromethane	EPA 601	<5.0	ug/kg	03/05/92
Vinyl chloride	EPA 601	<5.0	ug/kg	03/05/92
Benzene	EPA 602	<5.0	ug/kg	03/05/92
Chlorobenzene	EPA 602	<5.0	ug/kg	03/05/92
1,2-Dichlorobenzene	EPA 602	<5.0	ug/kg	03/05/92
1,3-Dichlorobenzene	EPA 602	<5.0	ug/kg	03/05/92
1,4-Dichlorobenzene	EPA 602	<5.0	ug/kg	03/05/92
Ethylbenzene	EPA 602	<5.0	ug/kg	03/05/92
Toluene	EPA 602	<5.0	ug/kg	03/05/92
MTBE	EPA 602	<5.0	ug/kg	03/05/92

HES

H.E.S.#: 920225J01

HUDSON ENVIRONMENTAL SERVICES, INC.

248 Queensbury Ave., P.O. Box 4601

Queensbury, New York 12804

518/792-3863

APPENDIX 33 - GROUND WATER MONITORING LIST

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
Acenaphthene	SW846-8270	<290	ug/kg	04/07/92
Acenaphthylene	SW846-8270	<290	ug/kg	04/07/92
Acetone	SW846-8240	<290	ug/kg	03/10/92
Acetophenone	SW846-8270	<290	ug/kg	04/07/92
Acetonitrile	SW846-8240	<89	ug/kg	03/10/92
2-Acetylaminofluorene	SW846-8270	<290	ug/kg	04/07/92
Acrolein	SW846-8240	<89	ug/kg	03/10/92
Acrylonitrile	SW846-8240	<89	ug/kg	03/10/92
Aldrin	SW846-8080	<20	ug/kg	03/13/92
Allyl chloride	SW846-8240	<89	ug/kg	03/10/92
4-Aminobiphenyl	SW846-8270	<290	ug/kg	04/07/92
Aniline	SW846-8270	<290	ug/kg	04/07/92
Anthracene	SW846-8270	<290	ug/kg	04/07/92
Antimony	SW846-7041	<100	ug/kg	03/05/92
Aramite	SW846-8270	<290	ug/kg	04/07/92
Arsenic	SW846-7060	60	ug/kg	03/12/92
Barium	SW846-7080	23,000	ug/kg	03/12/92
Benzene	SW846-8240	<89	ug/kg	03/10/92
Benzo(a)anthracene	SW846-8270	<290	ug/kg	04/07/92
Benzo(b)fluoranthene	SW846-8270	<290	ug/kg	04/07/92
Benzo(k)fluoranthene	SW846-8270	<290	ug/kg	04/07/92
Benzo(ghi)perylene	SW846-8270	<290	ug/kg	04/07/92
Benzo(a)pyrene	SW846-8270	<290	ug/kg	04/07/92
Benzyl alcohol	SW846-8270	<290	ug/kg	04/07/92
Beryllium	SW846-7091	<20	ug/kg	03/06/92
alpha-BHC	SW846-8080	<10	ug/kg	03/13/92
beta-BHC	SW846-8080	<10	ug/kg	03/13/92
delta-BHC	SW846-8080	<10	ug/kg	03/13/92
gamma-BHC; Lindane	SW846-8080	<10	ug/kg	03/13/92
Bis(2-chloroethoxy)methane	SW846-8270	<290	ug/kg	04/07/92
Bis(2-chloroethyl)ether	SW846-8270	<290	ug/kg	04/07/92
Bis(2-chloro-1-methylethyl) ether	SW846-8270	<290	ug/kg	04/07/92
Bis(2-ethylhexyl) phthalate	SW846-8270	<290	ug/kg	04/07/92
Bromodichloromethane	SW846-8240	<89	ug/kg	03/16/92
Bromoform	SW846-8240	<89	ug/kg	03/16/92
4-Bromophenyl phenyl ether	SW846-8270	<290	ug/kg	04/07/92
Butyl benzyl phthalate	SW846-8270	<290	ug/kg	04/07/92

HUDSON ENVIRONMENTAL SERVICES, INC.

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H.E.S. #: 920225J01

APPENDIX 33 - GROUND WATER MONITORING LIST

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
Cadmium	SW846-7131	<20	ug/kg	03/18/92
Carbon disulfide	SW846-8240	<89	ug/kg	03/10/92
Carbon tetrachloride	SW846-8240	<89	ug/kg	03/10/92
Chlordane	SW846-8080	<30	ug/kg	03/13/92
p-Chloroaniline	SW846-8270	<290	ug/kg	04/07/92
Chlorobenzene	SW846-8240	<89	ug/kg	03/10/92
Chlorobenzilate	SW846-8270	<290	ug/kg	04/07/92
p-Chloro-m-cresol	SW846-8270	<290	ug/kg	04/07/92
Chloroethane	SW846-8240	<180	ug/kg	03/10/92
Chloroform	SW846-8240	<89	ug/kg	03/10/92
2-Chloronaphthalene	SW846-8270	<290	ug/kg	04/07/92
2-Chlorophenol	SW846-8270	<290	ug/kg	04/07/92
4-Chlorophenyl phenyl ether	SW846-8270	<290	ug/kg	04/07/92
Chloroprene	SW846-8240	<89	ug/kg	03/10/92
Chromium	SW846-7191	6,500	ug/kg	03/02/92
Chrysene	SW846-8270	<290	ug/kg	04/07/92
Cobalt	SW846-7201	<4,600	ug/kg	03/31/92
Copper	SW846-7210	7,900	ug/kg	03/02/92
m-Cresol	SW846-8270	<290	ug/kg	04/07/92
o-cresol	SW846-8270	<290	ug/kg	04/07/92
p-Cresol	SW846-8270	<290	ug/kg	04/07/92
2,4-D	SW846-8150	<200	ug/kg	03/09/92
4,4-DDD	SW846-8080	<10	ug/kg	03/13/92
4,4-DDE	SW846-8080	<10	ug/kg	03/13/92
4,4-DDT	SW846-8080	<10	ug/kg	03/13/92
Diallate	SW846-8270	<290	ug/kg	04/07/92
Dibenz(a,h)anthracene	SW846-8270	<290	ug/kg	04/07/92
Dibromochloromethane	SW846-8240	<89	ug/kg	03/10/92
1,2-Dibromo-3-chloropropane	SW846-8240	<89	ug/kg	03/10/92
1,2-Dibromoethane	SW846-8240	<89	ug/kg	03/10/92
Di-n-butyl phthalate	SW846-8270	<290	ug/kg	04/07/92
o-Dichlorobenzene	SW846-8240	<89	ug/kg	03/10/92
m-Dichlorobenzene	SW846-8240	<89	ug/kg	03/10/92
p-Dichlorobenzene	SW846-8240	<89	ug/kg	03/10/92
3,3'-Dichlorobenzidine	SW846-8270	<290	ug/kg	04/07/92
trans-1,4-Dichloro-2-butene	SW846-8240	<89	ug/kg	03/10/92
Dichlorodifluoromethane	SW846-8240	<89	ug/kg	03/10/92

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H.E.S. #: 920225J01

APPENDIX 33 - GROUND WATER MONITORING LIST

PARAMETER	METHOD	RESULT	UNITS	TEST DATE
1,1-Dichloroethane	SW846-8240	<89	ug/kg	03/10/92
1,2-Dichloroethane	SW846-8240	<89	ug/kg	03/10/92
1,1-Dichloroethylene	SW846-8240	<89	ug/kg	03/10/92
trans-1,2-Dichloroethylene	SW846-8240	<89	ug/kg	03/10/92
2,4-Dichlorophenol	SW846-8270	<290	ug/kg	04/07/92
2,6-Dichlorophenol	SW846-8270	<290	ug/kg	04/07/92
1,2-Dichloropropane	SW846-8240	<89	ug/kg	03/10/92
cis-1,3-Dichloropropene	SW846-8240	<89	ug/kg	03/10/92
trans-1,3-Dichloropropene	SW846-8240	<89	ug/kg	03/10/92
Dieldrin	SW846-8080	<10	ug/kg	03/13/92
Diethyl phthalate	SW846-8270	<290	ug/kg	04/07/92
O,O-Diethyl O-2 pyrazinyl phos.	SW846-8270	<290	ug/kg	04/07/92
Dimethoate	SW846-8270	<290	ug/kg	04/07/92
p-(Dimethylamino)azobenzene	SW846-8270	<290	ug/kg	04/07/92
7,12-Dimethylbenz(a)anthracene	SW846-8270	<290	ug/kg	04/07/92
3,3'-Dimethylbenzidine	SW846-8270	<290	ug/kg	04/07/92
alpha,alpha-Dimethylphenethylamine	SW846-8270	<290	ug/kg	04/07/92
2,4-Dimethylphenol	SW846-8270	<290	ug/kg	04/07/92
Dimethyl phthalate	SW846-8270	<290	ug/kg	04/07/92
m-Dinitrobenzene	SW846-8270	<290	ug/kg	04/07/92
4,6-Dinitro-o-cresol	SW846-8270	<290	ug/kg	04/07/92
2,4-Dinitrophenol	SW846-8270	<1,450	ug/kg	04/07/92
2,4-Dinitrotoluene	SW846-8270	<290	ug/kg	04/07/92
2,6-Dinitrotoluene	SW846-8270	<290	ug/kg	04/07/92
Dinoseb	SW846-8270	<290	ug/kg	04/07/92
Di-n-octyl phthalate	SW846-8270	<290	ug/kg	04/07/92
1,4-Dioxane	SW846-8240	<89	ug/kg	03/10/92
Diphenylamine	SW846-8270	<290	ug/kg	04/07/92
Disulfoton	SW846-8270	<290	ug/kg	04/07/92
Endosulfan I	SW846-8080	<20	ug/kg	03/13/92
Endosulfan II	SW846-8080	<20	ug/kg	03/13/92
Endosulfan sulfate	SW846-8080	<20	ug/kg	03/13/92
Endrin	SW846-8080	<10	ug/kg	03/13/92
Endrin aldehyde	SW846-8080	<20	ug/kg	03/13/92
Ethylbenzene	SW846-8240	<89	ug/kg	03/10/92
Ethyl methacrylate	SW846-8240	<890	ug/kg	03/10/92
Ethyl methanesulfonate	SW846-8270	<290	ug/kg	04/07/92

HUDSON ENVIRONMENTAL SERVICES, INC.

248 Queensbury Ave., P.O. Box 4601

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518/792-3863

H.E.S. #: 920225JG1

APPENDIX 33 - GROUND WATER MONITORING LIST

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
Famphur	SW846-8270	<290	ug/kg	04/07/92
Fluoranthene	SW846-8270	<290	ug/kg	04/07/92
Fluorene	SW846-8270	<290	ug/kg	04/07/92
Heptachlor	SW846-8080	<20	ug/kg	03/13/92
Heptachlor epoxide	SW846-8080	<20	ug/kg	03/13/92
Hexachlorobenzene	SW846-8270	<290	ug/kg	04/07/92
Hexachlorobutadiene	SW846-8270	<290	ug/kg	04/07/92
Hexachlorocyclopentadiene	SW846-8270	<290	ug/kg	04/07/92
Hexachloroethane	SW846-8270	<290	ug/kg	04/07/92
Hexachlorophene	SW846-8270	<290	ug/kg	04/07/92
Hexachloropropene	SW846-8270	<290	ug/kg	04/07/92
2-Hexanone	SW846-8240	<180	ug/kg	03/10/92
Indeno (1,2,3-cd)pyrene	SW846-8270	<290	ug/kg	04/07/92
Isobutyl alcohol	SW846-8240	<89	ug/kg	03/10/92
Isodrin	SW846-8270	<290	ug/kg	04/07/92
Isophorone	SW846-8270	<290	ug/kg	04/07/92
Isosafrole	SW846-8270	<290	ug/kg	04/07/92
Kepone	SW846-8270	<290	ug/kg	04/07/92
Lead	SW846-7421	1,700	ug/kg	03/18/92
Mercury	SW846-7470	<100	ug/kg	03/05/92
Methacrylonitrile	SW846-8240	<89	ug/kg	03/10/92
Methapyrilene	SW846-8240	<89	ug/kg	03/10/92
Methoxychlor	SW846-8080	<30	ug/kg	03/13/92
Methyl bromide	SW846-8240	<180	ug/kg	03/10/92
Methyl chloride	SW846-8240	<180	ug/kg	03/10/92
3-Methylcholanthrene	SW846-8270	<290	ug/kg	04/07/92
Methylene bromide	SW846-8240	<89	ug/kg	03/10/92
Methylene chloride	SW846-8240	<89	ug/kg	03/10/92
Methyl ethyl ketone	SW846-8240	<89	ug/kg	03/10/92
Methyl iodide	SW846-8240	<89	ug/kg	03/10/92
Methyl methacrylate	SW846-8240	<890	ug/kg	03/10/92
Methyl methanesulfonate	SW846-8270	<290	ug/kg	04/07/92
2-Methylnaphthalene	SW846-8270	<290	ug/kg	04/07/92
Methyl parathion	SW846-8140	<200	ug/kg	03/09/92
4-Methyl-2-pentanone	SW846-8240	<180	ug/kg	03/10/92
Naphthalene	SW846-8270	<290	ug/kg	04/07/92
1,4-Naphthoquinone	SW846-8270	<290	ug/kg	04/07/92

HUDSON ENVIRONMENTAL SERVICES, INC.

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518/792-3863

H.E.S. #: 920225J01

APPENDIX 33 - GROUND WATER MONITORING LIST

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
1-Naphthylamine	SW846-8270	<290	ug/kg	04/07/92
2-Naphthylamine	SW846-8270	<290	ug/kg	04/07/92
Nickel	SW846-7520	4,200	ug/kg	03/02/92
o-Nitroaniline	SW846-8270	<290	ug/kg	04/07/92
m-Nitroaniline	SW846-8270	<290	ug/kg	04/07/92
p-Nitroaniline	SW846-8270	<290	ug/kg	04/07/92
Nitrobenzene	SW846-8270	<290	ug/kg	04/07/92
o-Nitrophenol	SW846-8270	<1,450	ug/kg	04/07/92
p-Nitrophenol	SW846-8270	<1,450	ug/kg	04/07/92
4-Nitroquinoline 1-oxide	SW846-8270	<290	ug/kg	04/07/92
N-Nitrosodi-n-butylamine	SW846-8270	<290	ug/kg	04/07/92
N-Nitrosodiethylamine	SW846-8270	<290	ug/kg	04/07/92
N-Nitrosodimethylamine	SW846-8270	<290	ug/kg	04/07/92
N-Nitrosodiphenylamine	SW846-8270	<290	ug/kg	04/07/92
N-Nitrosodipropylamine	SW846-8270	<290	ug/kg	04/07/92
N-Nitrosomethylethylamine	SW846-8270	<290	ug/kg	04/07/92
N-Nitrosomorpholine	SW846-8270	<290	ug/kg	04/07/92
N-Nitrosopiperidine	SW846-8270	<290	ug/kg	04/07/92
N-Nitrosopyrrolidine	SW846-8270	<290	ug/kg	04/07/92
5-Nitro-0-toluidine	SW846-8270	<290	ug/kg	04/07/92
Parathion	SW846-8140	<200	ug/kg	03/09/92
Total Polychlorinated biphenyls	SW846-8080	<10	ug/kg	03/09/92
Pentachlorobenzene	SW846-8270	<290	ug/kg	04/07/92
Pentachloroethane	SW846-8270	<290	ug/kg	04/07/92
Pentachloronitrobenzene	SW846-8270	<290	ug/kg	04/07/92
Pentachlorophenol	SW846-8270	<1,450	ug/kg	04/07/92
Phenacetin	SW846-8270	<290	ug/kg	04/07/92
Phenanthrene	SW846-8270	<290	ug/kg	04/07/92
Phenol	SW846-8270	<290	ug/kg	04/07/92
p-Phenylenediamine	SW846-8270	<290	ug/kg	04/07/92
Phorate	SW846-8140	<200	ug/kg	03/09/92
2-Picoline	SW846-8270	<290	ug/kg	04/07/92
Pronamide	SW846-8270	<290	ug/kg	04/07/92
Propionitrile	SW846-8240	<890	ug/kg	03/10/92
Pyrene	SW846-8270	<290	ug/kg	04/07/92
Pryidine	SW846-8270	<290	ug/kg	04/07/92
Safrole	SW846-8270	<290	ug/kg	04/07/92

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H.E.S. #: 920225J01

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<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
Selenium	SW846-7740	<70	ug/kg	03/12/92
Silver	SW846-7761	<90	ug/kg	03/02/92
Styrene	SW846-8240	<89	ug/kg	03/10/92
Sulfide	SW846-9030	48,000	ug/kg	04/14/92
2,4,5-T	SW846-8150	<20	ug/kg	03/09/92
1,2,4,5-Tetrachlorobenzene	SW846-8270	<290	ug/kg	04/07/92
1,1,1,2-Tetrachloroethane	SW846-8240	<89	ug/kg	03/10/92
1,1,2,2-Tetrachloroethane	SW846-8240	<89	ug/kg	03/10/92
Tetrachloroethylene	SW846-8240	<89	ug/kg	03/10/92
2,3,4,6-Tetrachlorophenol	SW846-8270	<290	ug/kg	04/07/92
Tetraethyl dithiopyrophosphate	SW846-8270	<290	ug/kg	04/07/92
Thallium	SW846-7841	<40	ug/kg	03/24/92
Tin	SW846-7870	<46,000	ug/kg	03/31/92
Toluene	SW846-8240	<89	ug/kg	03/10/92
o-Toluidine	SW846-8270	<290	ug/kg	04/07/92
1,2,4-Trichlorobenzene	SW846-8270	<290	ug/kg	04/07/92
1,1,1-Trichloroethane	SW846-8240	<89	ug/kg	03/10/92
1,1,2-Trichloroethane	SW846-8240	<89	ug/kg	03/10/92
Trichloroethylene	SW846-8240	<89	ug/kg	03/10/92
Trichlorofluoromethane	SW846-8240	<89	ug/kg	03/10/92
2,4,5-Trichlorophenol	SW846-8270	<290	ug/kg	04/07/92
2,4,6-Trichlorophenol	SW846-8270	<290	ug/kg	04/07/92
1,2,3-Trichloropropane	SW846-8240	<890	ug/kg	03/10/92
O,O,O-Triethyl phosphorothioate	SW846-8270	<290	ug/kg	04/07/92
sym-Trinitrobenzene	SW846-8270	<290	ug/kg	04/07/92
Vanadium	SW846-7911	<100	ug/kg	04/01/92
Vinyl acetate	SW846-8240	<180	ug/kg	03/10/92
Vinyl chloride	SW846-8240	<180	ug/kg	03/10/92
Xylene	SW846-8240	<89	ug/kg	03/10/92
Zinc	SW846-7950	7,500	ug/kg	03/02/92

HUDSON ENVIRONMENTAL SERVICES, INC.

248 Queensbury Ave., P.O. Box 4601

Queensbury, New York 12804

518/792-3863

HES

CLIENT: International Paper

QA/QC RESULTS

PRECISION

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
Antimony	RPD	12	%	03/05/92
Arsenic	RPD	<1.0	%	03/12/92
Beryllium	RPD	<1.0	%	03/06/92
Cadmium	RPD	<1.0	%	03/18/92
Total Chromium	RPD	8.0	%	03/02/92
Copper	RPD	13	%	03/02/92
Lead	RPD	<1.0	%	03/18/92
Mercury	RPD	<1.0	%	03/05/92
Nickel	RPD	<1.0	%	03/02/92
Potassium	RPD	12	%	03/02/92
Selenium	RPD	<1.0	%	03/12/92
Silver	RPD	<1.0	%	03/02/92
Thallium	RPD	57	%	03/24/92
Tin	RPD	<1.0	%	03/31/92
Vanadium	RPD	<1.0	%	04/01/92
Zinc	RPD	6.1	%	03/02/92
Calcium	RPD	<1.0	%	02/07/92
Fluoride	RPD	<1.0	%	03/19/92
Nitrogen, Nitrite	RPD	<1.0	%	03/19/92
Total, Phosphate	RPD	1.7	%	03/24/92
pH	RPD	<1.0	%	03/18/92
TVS	RPD	<1.0	%	03/19/92
Sulfate	RPD	<1.0	%	03/19/92
Chloride	RPD	<1.0	%	03/19/92
Total Solids	RPD	<1.0	%	03/19/92

HUDSON ENVIRONMENTAL SERVICES, INC.

248 Queensbury Ave., P.O. Box 4601

Queensbury, New York 12804

518/792-3863

CLIENT: International Paper

QA/QC RESULTS

ACCURACY

<u>PARAMETER</u>	<u>METHOD</u>	<u>RESULT</u>	<u>UNITS</u>	<u>TEST DATE</u>
Antimony	PSR	87	%	03/05/92
Arsenic	PSR	92	%	03/12/92
Beryllium	PSR	91	%	03/06/92
Cadmium	PSR	94	%	03/18/92
Total Chromium	PSR	100	%	03/02/92
Copper	PSR	75	%	03/02/92
Lead	PSR	95	%	03/18/92
Mercury	PSR	94	%	03/05/92
Nickel	PSR	91	%	03/02/92
Potassium	PSR	84	%	03/02/92
Selenium	PSR	86	%	03/12/92
Silver	PSR	94	%	03/02/92
Thallium	PSR	89	%	03/24/92
Tin	PSR	97	%	03/31/92
Vanadium	PSR	87	%	04/01/92
Zinc	PSR	94	%	03/02/92
TKN	PSR	103	%	03/18/92
Total Phosphate	PSR	112	%	03/24/92
Sulfate	PSR	106	%	03/19/92
Chloride	PSR	101	%	03/19/92

Approval By:

Date: 4/16/92

All samples were analyzed within EPA prescribed holding times.

N.Y.S.D.O.H. Lab ID# 11140

HUDSON ENVIRONMENTAL SERVICES, INC.
 248 Queensbury Ave., P.O. Box 4601
 Queensbury, N.Y. 12804
 518/792-3853

LAST MONTH
 SLUDGE RESULTS?

**CHAIN OF CUSTODY RECORD/
 Lab Work Request**

Client International Paper
 Client Contact/Person # Vyjay N. Panwar 518-684-3462
 Project Location Cornith, NY 12822

Purchase Order

HES Contact

* 1st Quote For HP H For Appendix 33

Bruce Frawley

HES Use Only Lab ID	Sample ID/Description	Date Collected	TIME A=a.m. P=p.m.	SAMPLE TYPE C=Composite G=Grab			# Conts.	ANALYSIS REQUIRED							
				MATRIX	C	G									
220225J01	Sludge Sample	2/24/92	3:00	SL			1	EPA SW 846- Method + refer instructions							
	Sludge "	2/24/92	3:00	SL			1	Pollutants identified by Subpart 3732, Appendix 33 and dioxin and furans (2378-TCDD, 2378-TCDF)							
Matrix S - Soil SE - Sediment SO - Solid				SL - Sludge O - Oil DW - Drinking Water GW - Ground Water				SW - Surface Water L - Leachate A - Air WI - Wipe				DS - Drum Solids DL - Drum Liquids X - Other WW - Waste Water			
Special Instructions: * Please refer to attached instructions															
Sampled by: (Signature)		Date/Time		Received by: (Signature)		Date/Time									
Relinquished by: (Signature)		Date/Time		Received by: (Signature)		Date/Time									
Relinquished by: (Signature)		Date/Time		Received by: (Signature)		Date/Time									
Dispatched by: (Signature)				Method of Shipment:				Date/Time							
Received @ Laboratory				Date/Time				Turnaround Time:							
				2/24/92 1:45 PM				Normal							
								Lab Approval:							

HES Use Only	
Samples Were:	
1. Shipped or Hand-Delivered	
NOTES: HES#1	
2. Ambient or Chilled	
NOTES: (N)	
3. Received Broken/Leaking (Improperly Sealed)	
NOTES: (N)	
4. Properly Preserved	
NOTES: (Y) N	
5. Received Within Holding Times	
NOTES: (Y) N	
COC Tape Was:	
1. Present on Outer Package	
Y N	
2. Unbroken on Outer Package	
Y N	
3. Present on Sample	
Y N	
4. Unbroken on Sample	
NOTES: Y N	
COC Record Was:	
1. Present upon Receipt of Samples	
(Y) N	
Discrepancies Between Sample Labels and COC Record?	
Y (N)	
NOTES:	

SARATOGA COUNTY SEWER DISTRICT NO. 1
CO-COMBUSTION STUDY QUESTIONNAIRE

THIS QUESTIONNAIRE WAS PREPARED BY CLOUGH, HARBOUR AND ASSOCIATES AS PART OF THE ENGINEERING SERVICES FOR THE SARATOGA COUNTY SEWER DISTRICT #1 CO-COMBUSTION STUDY. IN ORDER FOR THE STUDY TO CONTINUE AS SCHEDULED, THE INFORMATION REQUESTED HEREIN IS REQUIRED.

PLEASE BE AS ACCURATE AND CONCISE AS POSSIBLE WHEN COMPLETING THE QUESTIONNAIRE, AS THE INFORMATION GATHERED HERE WILL BE THE BASIS FOR ANY RECOMMENDATIONS TO BE MADE AT A LATER DATE.

IF ANY INFORMATION IS CONFIDENTIAL IN NATURE AND SHOULD NOT BE RELEASED WITHOUT CONSULTATION, PLEASE INDICATE SO.

YOUR COOPERATION IS GREATLY APPRECIATED.

A. GENERAL INFORMATION

1. Name of Paper Company: Mohawk Paper Mills, INC.
2. Contact Person at Facility: George W. Milner
Dir., Environmental Affairs

B. PAPER PRODUCTION

1. What are the average operating hours of the mill? 24 hrs./day,
6 days/wk., and 52 wks./yr.
2. How many, and what types of paper grades are produced at the mill? text and cover grades exclusively
3. What is the average daily paper production, in tons/day, at the mill? ≈ 120 tons/day
4. What is the maximum daily paper production, in tons/day, at the mill? ≈ 140 tons/day
5. Please list all existing environmental permits for your mill (for examples, SPDES, NPDES, Sewer Users' Permit, Air Permit, etc.). SPDES; AIR; Non-hazardous waste transporter permit; NO. 6 fuel oil storage permit, (Petroleum Bulk Storage.)
Please attach a copy of all existing environmental permits.
6. Is there any future expansion planned for the paper mill? Nothing definite.
If so, when? _____
Please give a description of the proposed expansion and explain the impacts that it will have on the current paper and sludge production. _____

C. ON-SITE WASTEWATER TREATMENT FACILITIES

1. Are there any wastewater treatment facilities at your mill? yes
If not, where is the untreated wastewater discharged? _____

2. Please list and give a description of each of the on-site wastewater treatment facilities. our wastewater facility consists of a dissolved air flotation clarifier preceded by rotating pre-stripping screens. The sludge is dewatered in a screw press to a 40-50% solids content.

✓
X Please attach a process flow sketch of the facilities. See SPOES Permit

3. What is the average daily and maximum daily wastewater flow through the treatment facilities? AVG = ≈ 1.3 mgd, MAX = 1.8 mgd.

4. What effect does the variation in paper grade have on wastewater treatment? _____
When we manufacture recycled paper our solids losses tend to increase.

5. Please list the different plant operations and show each operation's contribution to wastewater flow:

<u>Operation</u>	<u>Average Flow</u>
MANUFACTURING (PAPER MAKING)	75%
UTILITY SERVICES	15%
① water plant	
② boiler	
③ air compressor	
Clean-ups.	10%

6. What are the current annual operation and maintenance costs for the wastewater treatment facility? ~ \$200,000/year

Attach a detailed breakdown of operation and maintenance costs, such as labor, materials, electricity, etc.
 LABOR — \$80,000 MAINTENANCE — \$45,000
 POWER — \$15,000
 MAT'L'S — \$60,000

7. Where is the treated effluent discharged? Mohawk River

8. Are you now required by any federal, state, or local authority to meet any implementation schedule for the construction, upgrading, or operation of wastewater treatment equipment or practices, or any other environmental programs which may affect the discharges? NO If yes, please explain.

- ✓ X 9. Please attach a copy of required effluent parameters and any operating records which exist for the wastewater treatment facilities for the past 2 years.

SEE SPDES → NO Permit violations

D. SLUDGE PRODUCTION AND DISPOSAL FACILITIES

* wet tons.

1. What is the average daily sludge production? 3.65^{*} tons/day, _____ yd³/day.
Maximum daily sludge production? 7.3 tons/day, _____ yd³/day.
Minimum daily sludge production? 0 tons/day, _____ yd³/day.

Please attach any sludge production records which may exist.

2. Please list and give a description of all on-site sludge management facilities.

The sludge that is scrapped off the surface of the Dissolved Air Flotation Clarifier is stored in a 40,000 gallon pit from where it is pumped to a screw press. The resultant mat'l is always between 40 and 50 percent solids.

Please attach a process flow sketch of these facilities.

3. What effect does the variation in paper grade have on sludge production? _____

We produce more sludge when we are manufacturing recycled paper.

- ✓
* 4. What analyses are performed on the sludge? see attached.

How often are these tests performed? _____

as required

- ✓
* Please attach copies of the sludge test results for the past 2 years.

5. Please list the average and maximum quantities of the sludge for each of the parameters listed below:

	<u>Average</u>	<u>Maximum</u>
• Total Suspended Solids (TSS) (mg/l)	?	
• Volatile Suspended Solids (VSS) (mg/l)	UNKNOWN	
• BOD ₅ (mg/l)	?	
• Clay Content (mg/l)	VARIES	
• Ash Content (mg/l or %)	typically 20%	
• pH	6.5 → 8.0	
• BTU Value of Sludge (BTU/lb.)	UNKNOWN	

6. After on-site treatment, where is the sludge disposed?

It is being beneficially used as a source of fiber at another paper mill.

7. What are the annual costs for the current method of sludge disposal? (Please give a detailed breakdown of costs, such as labor, trucking, tipping fees, etc.)

Trucking + driver + misc. = \$20,000

8. Is there any on-site sludge storage available? NO

If so, how much?

9. Please attach a copy of any TCLP test results, and any other sludge testing results which may exist.

SARATOGA COUNTY SEWER DISTRICT NO. 1
CO-COMBUSTION STUDY QUESTIONNAIRE

THIS QUESTIONNAIRE WAS PREPARED BY CLOUGH, HARBOUR AND ASSOCIATES AS PART OF THE ENGINEERING SERVICES FOR THE SARATOGA COUNTY SEWER DISTRICT #1 CO-COMBUSTION STUDY. IN ORDER FOR THE STUDY TO CONTINUE AS SCHEDULED, THE INFORMATION REQUESTED HEREIN IS REQUIRED.

PLEASE BE AS ACCURATE AND CONCISE AS POSSIBLE WHEN COMPLETING THE QUESTIONNAIRE, AS THE INFORMATION GATHERED HERE WILL BE THE BASIS FOR ANY RECOMMENDATIONS TO BE MADE AT A LATER DATE.

IF ANY INFORMATION IS CONFIDENTIAL IN NATURE AND SHOULD NOT BE RELEASED WITHOUT CONSULTATION, PLEASE INDICATE SO.

YOUR COOPERATION IS GREATLY APPRECIATED.

A. GENERAL INFORMATION

1. Name of Paper Company: TAGSON'S PAPERS, INC
2. Contact Person at Facility: GARY BUEA, VICE PRESIDENT OF
MANUFACTURING

B. PAPER PRODUCTION

1. What are the average operating hours of the mill? 24 hrs./day,
7 days/wk., and ~~50~~ 50 wks./yr. - NONOALLY 2 WEEKS
OF SHUTDOWN FOR MAINTENANCE EACH YEAR
2. How many, and what types of paper grades are produced at the mill? BLEACH
KRAFT, AND NATURAL GRADE ROLL TOWELING, PAPER IS
PRODUCED BY REPULPING AND PROCESSING (I.E. DEINKING)
WASTE PAPER
3. What is the average daily paper production, in tons/day, at the mill? 144
TONS PER DAY - MACHINE IS DESIGNED FOR 200 TPD MAXIMUM
4. What is the maximum daily paper production, in tons/day, at the mill? 200 TPD
- OCCASIONALLY SLIGHTLY GREATER THAN THIS AMOUNT
5. Please list all existing environmental permits for your mill (for examples, SPDES, NPDES, Sewer Users' Permit, Air Permit, etc.). VCSO NO. 1 SIGNIFICANT
INDUSTRIAL USE PERMIT, AIR PERMIT FOR BOILERHOUSE STACK,
STORMWATER PERMIT
Please attach a copy of all existing environmental permits.
6. Is there any future expansion planned for the paper mill? NOT PRESENTLY
If so, when? NA
Please give a description of the proposed expansion and explain the impacts that it
will have on the current paper and sludge production. NA

C. ON-SITE WASTEWATER TREATMENT FACILITIES

1. Are there any wastewater treatment facilities at your mill? NO
If not, where is the untreated wastewater discharged? TO THE VAMATOBA
COUNTY VAMON DISTRICT NO. 1

2. Please list and give a description of each of the on-site wastewater treatment facilities. THERE ARE PRESENTLY NO ON-SITE WASTEWATER
TREATMENT FACILITIES. WASTEWATER LEAVING THE
PLANT UNDERGOES COMPLE VORCENING THROUGH A
BAM RACK, IS TREATMENT USING A PARTICULATE FURF,
AND THEN IS DISCHARGED TO THE COUNTY VAMON
DISTRICT

- Please attach a process flow sketch of the facilities. (ATTACHED)

3. What is the average daily and maximum daily wastewater flow through the treatment facilities? THE CURRENT AVERAGE FLOW FROM THE MILL IS
APPROXIMATELY 1.0 MGD. PEAK FLOWS MAY REACH 1.5
MGD

4. What effect does the variation in paper grade have on wastewater treatment? THE HIGHEST VOLUME LOADS AND BOD₅ LOADS
OCCUR WHEN RUNNING ON BLEACH

5. Please list the different plant operations and show each operation's contribution to wastewater flow:

<u>Operation</u>	<u>Average Flow</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

6. What are the current annual operation and maintenance costs for the wastewater treatment facility? TABSONS CURRENTLY PAYS A SEWER DISTRICT
USEN CHARGE OF ABOUT \$250,000 / YEAR

Attach a detailed breakdown of operation and maintenance costs, such as labor, materials, electricity, etc. NA

7. Where is the treated effluent discharged? TO THE HUDON RIVER VIA
THE VARADOGA COUNTY SEWER DISTRICT NO. 1

8. Are you now required by any federal, state, or local authority to meet any implementation schedule for the construction, upgrading, or operation of wastewater treatment equipment or practices, or any other environmental programs which may affect the discharges? YES If yes, please explain. TABSONS HAS
ENTERED INTO AN ORDER ON CONSENT TO CONSTRUCT
WASTEWATER PRETREATMENT FACILITIES WHICH WILL INCLUDE
A KRAFTA DISSOLVED AIR FLotation THICKENING. FLAT
WILL BE PULPED THROUGH A VERAGE FUNCTIONAL TO THE
VEDO NO. 1 ON EIGHTON PASSES FOR DISCHARGE IN AN
APPROVED MANDATE.

9. Please attach a copy of required effluent parameters and any operating records which exist for the wastewater treatment facilities for the past 2 years.

DAILY DISCHARGE RECORDS FOR THE DILL VINCE
DAILY MONITORING BEGAN IN FEBRUARY ARE ATTACHED.
INTERIM DISCHARGE LIMITS AND EXPECTED FINAL
DISCHARGE LIMITS ARE ALSO ATTACHED

D. SLUDGE PRODUCTION AND DISPOSAL FACILITIES

1. What is the average daily ^{DAY SOLIDS} sludge production? 10-15 tons/day, NA yd³/day.
Maximum daily ^{DAY SOLIDS} sludge production? 20 tons/day, NA yd³/day.
Minimum daily ^{DAY SOLIDS} sludge production? 5 tons/day, NA yd³/day.
Please attach any ^{SOLID} sludge production records which may exist. (SEE QUESTION C (9))

2. Please list and give a description of all on-site sludge management facilities.

THERE ARE PRESENTLY NO ON-SITE SLUDGE MANAGEMENT
FACILITIES. ~~MINIMUMALLY PROPOSED WASTEWATER~~
~~PRODUCTION UTILITIES WILL BE USED TO TREAT WASTE~~ A PROCESS
FLOW DIAGRAM FOR THE PROPOSED WASTEWATER
PRODUCTION FACILITIES IS ATTACHED

Please attach a process flow sketch of these facilities.

3. What effect does the variation in paper grade have on sludge production? _____

EFFLUENT VOLUMES AND BOD₅ ARE HIGHEST WHEN
OPERATING ON BUGHY

4. What analyses are performed on the sludge? WASTEWATER IS TESTED FOR
BOD₅, TSS, PH AND PERIODICALLY FOR ZINC

How often are these tests performed? BOD₅, TSS AND PH ARE
RUN DAILY; ZINC IS TESTED

Please attach copies of the sludge test results for the past 2 years.

SEE RESPONSE TO C (9)

5. Please list the average and maximum quantities of the sludge for each of the parameters listed below:

	<u>Average</u>	<u>Maximum</u>
• Total Suspended Solids (TSS) (mg/l)	_____	_____
• Volatile Suspended Solids (VSS) (mg/l)	_____	_____
• BOD ₅ (mg/l)	_____	_____
• Clay Content (mg/l)	_____	_____
• Ash Content (mg/l or %)	_____	_____
• pH	_____	_____
• BTU Value of Sludge (BTU/lb.)	_____	_____

6. After on-site treatment, where is the sludge disposed? WASTE VOLUOS
PRODUCED BY TABSONS ARE ULTIMATELY INCINERATED
WITH DOMESTIC WASTE WASTE AT THE VANATOGA
COUNTY TREATMENT PLANT
7. What are the annual costs for the current method of sludge disposal? (Please give a detailed breakdown of costs, such as labor, trucking, tipping fees, etc.)
WASTE DISPOSAL COSTS ARE INCLUDED IN THE
USEN CHARGES FOR WASTEWATER DISPOSAL ASSESSED
BY THE VANATOGA COUNTY WARDEN DISTRICT NO. 1
8. Is there any on-site sludge storage available? 50,000 GALLONS PROPOSED
 If so, how much? _____
9. Please attach a copy of any TCLP test results, and any other sludge testing results which may exist.

"
 TCLP TESTS HAVE BEEN RUN ON "VEGETING" FROM THE
 DILL AND ARE ATTACHED. THESE RESULTS WOULD
 BE INDICATIVE OF EXPECTED TCLP TESTING FOR SLUDGE

APPENDIX C

SLUDGE QUANTITY AND TOTAL SOLIDS CONTENTS CONFIRMATION LETTERS

CLOUGH, HARBOUR & ASSOCIATES

ENGINEERS, SURVEYORS & PLANNERS

ALBANY & ROCHESTER, NEW YORK • HARTFORD, CONNECTICUT
BURLINGTON & MANCHESTER CENTER, VERMONT
KEENE, NEW HAMPSHIRE • GREENFIELD, MASSACHUSETTS
FALMOUTH, MAINE • MALVERN, PENNSYLVANIA

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(1926 - 1990)

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THOMAS J. WOLANSKI, P.E.

COMPTROLLER

DAVID R. WAHRMUCH, C.P.A.

DIR. PROJ. DEVELOP.

RAYMOND J. KINLEY, JR.

SERVICE GROUP MANAGER

DAVID O. KELLY

January 6, 1993

Mr. Jeffrey L. Davis, Plant Manager
Encore Paper Company
1 River Street
South Glens Falls, New York 12803

**RE: FEASIBILITY STUDY FOR THE CO-COMBUSTION OF MUNICIPAL
SEWAGE SLUDGE WITH PAPER SLUDGE
CHA FILE NO. 2753-22.01**

Dear Mr. Davis:

Based on your telephone conversation today with Deirdre Handcock of our office, we are writing this letter to confirm the expected quantities and characteristics of sludge which you would contribute to the County facility if disposal costs are acceptable and appropriate agreements are reached. These figures are:

75 tons/day of dry sludge (0% water) (525 tons/week of dry sludge).
Encore would provide the sludge at approximately 28% to 32% solids.

Please feel free to contact me should you have any questions or comments regarding the project.

Very truly yours,

**CLOUGH, HARBOUR & ASSOCIATES
ENGINEERS, SURVEYORS & PLANNERS**

Shawn H. Veltman, P.E.
Partner

DJH/kt
2753-C4

cc: Ray Beaudoin, SCSD No. 1

CLOUGH, HARBOUR & ASSOCIATES

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COMPTROLLER

DAVID R. WAHRMICH, C.P.A.

DIR. PROJ. DEVELOP.

RAYMOND J. KINLEY, JR.

SERVICE GROUP MANAGER

DAVID O. KELLY

December 29, 1992

Mr. Stuart Field, Manager - Manufacturing
International Paper
15 Pine Street
Corinth, New York 12822

**RE: FEASIBILITY STUDY FOR THE CO-COMBUSTION OF MUNICIPAL
SEWAGE SLUDGE WITH PAPER SLUDGE
CHA FILE NO. 2753-22.01**

Dear Mr. Field:

Based on the information we have received from your company, Clough, Harbour & Associates is presently completing the economic analysis on the feasibility of co-combusting your sludge with municipal sewage sludge at the Saratoga County Sewer District No. 1. We are writing this letter to confirm the expected quantities and characteristics of sludge which you would contribute to the County facility if disposal costs are acceptable and appropriate agreements are reached. These figures are:

44.4 tons/day of dewatered sludge from your proposed screw press (311 tons/week of dewatered sludge) at approximately 45% solids.

If these quantities and percent solids are not correct, please contact Deirdre Handcock at 453-3923 as soon as possible so that we can make the necessary changes. Please feel free to contact me should you have any questions or comments regarding the project.

Very truly yours,

**CLOUGH, HARBOUR & ASSOCIATES
ENGINEERS, SURVEYORS & PLANNERS**

Shawn H. Veltman, P.E.
Associate

DJH/kt
2753-C3B

cc: Ray Beaudoin, SCSD No. 1

CHA

**CLOUGH, HARBOUR
& ASSOCIATES**

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JAMES D. RYAN, P.E.RONALD J. CLOUGH, P.E.
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DIR. PROJ. DEVELOP.

RAYMOND J. KINLEY, JR.

SERVICE GROUP MANAGER

DAVID G. KELLY

December 29, 1992

Mr. George W. Milner
Environmental Compliance Mgr.
Mohawk Paper Mills, Inc.
465 Saratoga Street, P.O. Box 497
Cohoes, New York 12047**RE: FEASIBILITY STUDY FOR THE CO-COMBUSTION OF MUNICIPAL
SEWAGE SLUDGE WITH PAPER SLUDGE
CHA FILE NO. 2753-22.01**

Dear Mr. Milner:

Based on the information we have received from your company, Clough, Harbour & Associates is presently completing the economic analysis on the feasibility of co-combusting your sludge with municipal sewage sludge at the Saratoga County Sewer District No. 1. We are writing this letter to confirm the expected quantities and characteristics of sludge which you would contribute to the County facility if disposal costs are acceptable and appropriate agreements are reached. These figures are:

4.5 tons/day of dewatered sludge from your existing screw press (31.5
tons/week of dewatered sludge) at approximately 45% solids.

If these quantities and percent solids are not correct, please contact Deirdre Handcock at 453-3923 as soon as possible so that we can make the necessary changes. Please feel free to contact me should you have any questions or comments regarding the project.

Very truly yours,

**CLOUGH, HARBOUR & ASSOCIATES
ENGINEERS, SURVEYORS & PLANNERS**
Shawn H. Veltman, P.E.
AssociateDJH/kt
2753-C3C

cc: Ray Beaudoin, SCSD No. 1

CLOUGH, HARBOUR & ASSOCIATES

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THOMAS J. WOLANSKI, P.E.

COMPTROLLER

DAVID R. WAHRLECH, C.P.A.

DIR. PROJ. DEVELOP.

RAYMOND J. KINLEY, JR.

SERVICE GROUP MANAGER

DAVID O. KELLY

December 29, 1992

Mr. Thomas A. Galante, II
TAGSONS Papers, Inc.
99 Broadway, P.O. Box 1999
Albany, New York 12201-1999

**RE: FEASIBILITY STUDY FOR THE CO-COMBUSTION OF MUNICIPAL
SEWAGE SLUDGE WITH PAPER SLUDGE
CHA FILE NO. 2753-22.01**

Dear Mr. Galante:

Based on the information we have received from your company, Clough, Harbour & Associates is presently completing the economic analysis on the feasibility of co-combusting your sludge with municipal sewage sludge at the Saratoga County Sewer District No. 1. We are writing this letter to confirm the expected quantities and characteristics of sludge which you would contribute to the County facility if disposal costs are acceptable and appropriate agreements are reached. These figures are:

20 dry tons of solids per day.

If these quantities and percent solids are not correct, please contact Deirdre Handcock at 453-3923 as soon as possible so that we can make the necessary changes. Please feel free to contact me should you have any questions or comments regarding the project.

Very truly yours,

CLOUGH, HARBOUR & ASSOCIATES
ENGINEERS, SURVEYORS & PLANNERS

Shawn H. Veltman, P.E.
Associate

DJH/kt
2753-C3E

cc: Ray Beaudoin, SCSD No. 1

APPENDIX D

COMPLETED SEPTEMBER 1993 QUESTIONNAIRES

SUMMARY OF RESPONSES TO QUESTIONNAIRE – SEPTEMBER, 1993

PAPER COMPANY	MAXIMUM TIPPING FEE \$ / DRY TON	PROPOSED AVERAGE DAILY QUANTITY OF PAPER MILL SLUDGE DELIVERED TO SITE		MILL OPERATING HOURS	
		TON / DAY @ SOLIDS	DRY TON BASIS TON / DAY @ SOLIDS	DAYS / WEEK	WEEKS / YEAR
Cottrell Paper Company	\$60	2.5 @ 24%	0.6 @ 100%	3	48
Encore Paper Company	\$20	300 @ 30%	75 @ 100%	7	52
International Paper Company	\$23	89 @ 45%	40 @ 100%	7	51
Mohawk Paper Mills	\$50	4.65 @ 43%	2 @ 100%	6	52
TAGSONS Papers	\$40	10 to 20 @ 6%	10 to 20 @ 100%	7	50

QUESTIONNAIRE

CO-COMBUSTION FEASIBILITY STUDY
DUE SEPTEMBER 3, 1993

PAPER COMPANY NAME: COTTRELL PAPER CO.

MAXIMUM TIPPING FEE: \$ 60.00 / ton of paper mill sludge (based on dry tons)

AVERAGE DAILY QUANTITY OF PAPER MILL SLUDGE DELIVERED TO SITE:

2.5 tons / day at 24 % solids

.6 tons / day at 0 % ^{moisture} solids (dry tons)

* 3 days / week, 48 weeks / year

* WE CAN PRODUCE OUR QUOTA (15 WAT/TONS PER WEEK) IN
THREE (3) DAYS.

Post-It™ brand fax transmittal memo 7b71		# of pages + 1
To	Mr RAY BEAUDOIN	
From	J. DAVIS	
Co.	S. C. S. D.	
Co.	ENCORE	
Dept.		
Phone #	793 5624 (GAS)	
Fax #	664 6280	
Fax #	793 3650	

QUESTIONNAIRECO-COMBUSTION FEASIBILITY STUDY
DUE SEPTEMBER 3, 1993PAPER COMPANY NAME: ENCORE PAPER CO.MAXIMUM TIPPING FEE: \$ 20.00 / ton of paper mill sludge (based on dry 100%)

AVERAGE DAILY QUANTITY OF PAPER MILL SLUDGE DELIVERED TO SITE:

300 tons / day at 30 % solids75 tons / day at 0 % ^{MOISTURE} ~~solids~~ (dry 100%)1 days / week, 52 weeks / year

QUESTIONNAIRE

CO-COMBUSTION FEASIBILITY STUDY
DUE SEPTEMBER 3, 1993

PAPER COMPANY NAME: INTERNATIONAL PAPER

MAXIMUM TIPPING FEE: \$ 23 / ton of paper mill sludge (based on dry tons)

AVERAGE DAILY QUANTITY OF PAPER MILL SLUDGE DELIVERED TO SITE:

89 tons / day at 45 % solids

40 tons / day at 0 % ^{moisture} solids (dry tons)

7 days / week, 51 weeks / year

Post-It™ brand fax transmittal memo 7671		# of pages
To <u>Shawn Veltman</u>	From <u>Midge Barile</u>	
Co. <u>CH4</u>	Co. <u>SCSD</u>	
Dept.	Phone #	
Fax # <u>458-1735</u>	Fax # <u>664-6280</u>	

RECEIVED	
SEP 22 1993	
SARATOGA COUNTY SEWER DISTRICT NO. 1	

Fax # 654-3487 Fax # 664-6280
PLEASE COMPLETE & FAX TO SCSD BY

To	<i>Nede Handcock</i>	From	<i>M. Park</i>
Co.	<i>C-Harbour</i>	Co.	<i>SCSD-#1</i>
Dept.	<i># 458-1735</i>	Phone #	<i>664-7396</i>
Fax	<i>no answer from</i>	Fax	<i>Internatl.</i>

QUESTIONNAIRECO-COMBUSTION FEASIBILITY STUDY
DUE SEPTEMBER 3, 1993PAPER COMPANY NAME: MOHAWK PAPER MILLS, INC.~~NO~~ NO HIGHER THANMAXIMUM TIPPING FEE: \$ 50 / ton of paper mill sludge (based on dry tons)

AVERAGE DAILY QUANTITY OF PAPER MILL SLUDGE DELIVERED TO SITE:

4.65 tons / day at 43 % solids2 tons / day at 0 % ^{moisture} solids (dry tons)6 days / week , 52 weeks / year

Post-It™ brand fax transmittal memo 7671		# of pages > 1
To <i>Ned Hancock</i>	From <i>Th. Park</i>	
Co. <i>C-Harbour</i>	Co. <i>SCSD #1</i>	
Dept.	Phone # <i>664-7396</i>	
Fax # <i>458-1735</i>	Fax # <i>664-6280</i>	

QUESTIONNAIRE

**CO-COMBUSTION FEASIBILITY STUDY
DUE SEPTEMBER 3, 1993**

PAPER COMPANY NAME: *Tagsons Papers Inc.*

MAXIMUM TIPPING FEE: \$ *40.00* / ton of paper mill sludge (*based on dry tons*)

AVERAGE DAILY QUANTITY OF PAPER MILL SLUDGE DELIVERED TO SITE:

10/20 tons / day at *6* % solids (*pumped in pipe line*)

10/20 tons / day at *0* % ^{moisture} solids (*dry tons*)

7 days / week, *50* weeks / year

Jeffrey Ellis
Purchasing Manager

APPENDIX E

SLUDGE SAMPLING AND ANALYSIS PROGRAM AND SUMMARY OF SLUDGE TEST RESULTS

SAMPLING AND ANALYSIS PROGRAM

Completed questionnaires were received from Cottrell Paper Company, Encore Paper Company, International Paper Company, Mohawk Paper Mills, and TAGSONS Papers (the participating paper companies). Based on a review of the questionnaires and based on follow-up meetings and/or conversations with each of the participating paper companies, the following sampling and analysis program has been developed to confirm and/or determine the characteristics of the sludge to be provided by the participants.

Samples will be collected from each of the participating paper companies and the Saratoga County Sewer District No. 1. Each sample will be analyzed at Adirondack Environmental Services Inc. or Upstate Laboratories Inc., depending on the type of analysis to be performed. The sampling and analysis program has been divided into two parts; Part 1 consists of total solids, total volatile solids, and sludge Btu tests, and Part 2 consists of TCLP, chloride, and NYSDEC Part 360-3 ash regulation metals tests. The purpose of these tests is as follows:

<u>Test</u>	<u>Purpose</u>
Total Solids	To determine the quantity of solids in each participant's sludge.
Btu Value	To determine the energy value of the sludge solids.
Total Volatile Solids	To determine the quantity of volatile and nonvolatile solids in the sludge.
TCLP	To determine the toxicity characteristics of the sludge.
Part 360-3 Metals	To determine the presence of metals in the sludge which could effect solids handling and disposal.

PART 1: TOTAL SOLIDS, TOTAL VOLATILE SOLIDS, AND SLUDGE BTU VALUE SAMPLING AND ANALYSIS

The rationale for the number of samples and type of Part 1 sludge tests to be performed is described for each participating paper company and the Sewer District in this section.

Cottrell Paper Company

Based on a review of the questionnaire completed by Cottrell Paper Company (Cottrell), and based on telephone conversations with Cottrell, nine analyses will be performed on Cottrell's sludge.

Based on correspondence with the paper company, the sludge quality is consistent and is independent of any variations in paper grade being produced at the mill. Cottrell operates their mill 5 days per week and operates their belt filter press 2 days per week. There is no known Btu data of Cottrell's sludge. Four samples of Cottrell's dewatered sludge will be collected and tested as follows:

Sample No. 1 will be a composite sample consisting of three grab samples of dewatered sludge collected during a belt filter press run. This composite sample will be analyzed for total solids.

Sample No. 2 will be a composite sample consisting of three grab samples of dewatered sludge collected during a belt filter press run. This composite sample will be analyzed for total solids, total volatile solids, and Btu value.

Sample No. 3 will be a composite sample consisting of three grab samples of dewatered sludge collected during a belt filter press run. This composite sample will be analyzed for total solids, total volatile solids, and Btu value.

Sample No. 4 will be a composite sample consisting of three grab samples of dewatered sludge collected during a belt filter press run. This composite sample will be analyzed for total solids and Btu value.

Encore Paper Company

Based on a review of the questionnaire completed by Encore Paper Company (Encore), and based on meetings and telephone conversations with Encore, five analyses will be performed on Encore's sludge.

Based on correspondence with the paper company, the effect of the variation in paper grade on wastewater and sludge production is minimal. Encore currently performs total solids and total volatile solids tests on their sludge three times per day (once during each 8-hour shift). Encore has provided daily sludge test results for November and December 1992. Based on a review of these test results, it is apparent that the results are consistent. The average total solids and total volatile solids test results varied only 2 to 3 % throughout the testing period. Therefore, it is recommended that the existing data be used for the feasibility study. One additional total solids and total volatile solids tests will be performed to confirm the results of the existing sludge data. There is no known Btu data of Encore's sludge. Three samples of Encore's dewatered sludge will be collected and tested as follows:

Sample No. 1 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for total solids, total volatile solids, and Btu value.

Sample No. 2 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for Btu value.

Sample No. 3 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for Btu value.

International Paper Company

Based on a review of the questionnaire completed by the International Paper Company (I.P.), and based on meetings and conversations with the paper company, seven analysis will be performed on I.P.'s sludge.

Based on correspondence with the paper company, the effect of the variation in paper grade on wastewater and sludge production is minimal. I.P. has performed several total solids and total volatile solids tests on their sludge and has provided this information for review. Based on a review of these test results, the total

solids content and total volatile solids content are consistent. Additional total solids and one total volatile solids test will be performed on I.P.'s dewatered sludge to confirm the results of the existing sludge data. There is no known Btu data of I.P.'s sludge. Four samples of I.P.'s dewatered sludge will be collected and tested as follows:

Sample No. 1 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for total solids content.

Sample No. 2 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for total solids, total volatile solids, and Btu value.

Sample No. 3 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for Btu value.

Sample No. 4 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for total solids and Btu value.

Mohawk Paper Mills

Based on a review of the questionnaire completed by Mohawk Paper Mills (Mohawk), and based on conversations with the paper company, 10 analyses will be performed on Mohawk's sludge.

Based on correspondence with the paper company, the total solids content and ash content of Mohawk's dewatered sludge is consistent at approximately 40 to 50% solids and 20% ash content. To verify this, two grab samples of Mohawk's dewatered sludge will be collected and analyzed for total solids and ash content. In addition, two additional total solids and one total volatile solids test will be performed on a composite sample of Mohawk's sludge. There is no known Btu data available. Five samples of Mohawk's dewatered sludge will be collected and tested as follows:

Sample No. 1 will be a grab sample and will be analyzed for total solids and ash content.

Sample No. 2 will be a grab sample and will be analyzed for total solids and ash content.

Sample No. 3 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for total solids, total volatile solids, and Btu value.

Sample No. 4 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for Btu value.

Sample No. 5 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for total solids and Btu value.

TAGSONS Papers and the Saratoga County Sewer District No. 1

Based on a review of the questionnaire completed by TAGSONS Papers (TAGSONS), and based on meetings and conversations with TAGSONS and the Sewer District, six analyses will be performed on the Sewer District's sludge. TAGSONS' presently discharges their wastewater to the Sewer District's trunk sewer; therefore, the test results of the Sewer District's sludge will include TAGSONS' solids.

The Sewer District routinely tests their sludge for total solids and total volatile solids. In addition to the Sewer District's data, TAGSONS currently tests their wastewater daily for total solids. TAGSONS has two existing Btu test results. The Sewer District and TAGSONS have made all of their existing sludge data available. Based on a review of this data, three samples of the Sewer District's dewatered sludge will be collected and tested as follows:

Sample No. 1 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for total solids, total volatile solids, and Btu value.

Sample No. 2 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for Btu value.

Sample No. 3 will be a composite sample consisting of three grab samples of dewatered sludge collected per day for 2 days (six grab samples total). This composite sample will be analyzed for total solids and Btu value.

PART 2: CHLORIDE, PART 360-3 METALS, AND TCLP SAMPLING AND ANALYSIS

The rationale for the number of samples and type of Part 2 tests to be performed is described in this section.

Chloride

A composite sample of three grab samples per day for 2 days (six grab samples total) will be collected from each participant (except Cottrell; because of their existing belt filter press operating schedule, Cottrell's composite sample will consist of three grab samples). Each of these sludge samples will be analyzed for chloride content.

Part 360-3 Metals

A composite sample of three grab samples per day for 2 days (six grab samples total) will be collected from each participant (except Cottrell). Each of the participant's composite sample will be further composited into one composite sample based on the projected quantities of sludge to be contributed by each participant. This composite sample will be analyzed as follows:

Test No. 1 will consist of preparing a TCLP extract and analyzing the extract for the NYSDEC Part 360-3 ash regulation metals, which include: antimony, arsenic, beryllium, barium, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, silver, thallium, zinc, calcium, iron, silicon, tin, aluminum, chloride, and sulfate.

Test No. 2 will consist of analyzing the sludge for the NYSDEC Part 360-3 ash regulation metals listed above.

TCLP

Existing TCLP analyses from Encore Paper Company, International Paper Company, Mohawk Paper Mills, TAGSONS Papers, and partial TCLP analyses from the Sewer District (which includes TAGSONS' solids) are available. Two additional TCLP analyses will be performed as follow:

Sample No. 1 will be a composite of three grab samples of Cottrell's dewatered sludge.

Sample No. 2 will be a composite of six grab samples taken over 2 days of the Sewer District's dewatered sludge.

Thus, TCLP data will be available for each participant's sludge.

SUMMARY OF SLUDGE TEST RESULTS				
PARTICIPANT	SAMPLING DATE	TOTAL SOLIDS (%)	TOTAL VOLATILE SOLIDS (%)	BTU VALUE PER LB DRY SOLIDS
Cottrell Paper Company	09/05/91	28.8		
	10/31/91		79.9	
	12/16/92	22		
	01/12/93	22	86	
	01/12/93	22	86	6,400
	01/19/93	21	86	
	01/19/93			7,300
	10/11/93	17		7,200
	Average:	22	84	6,967
Encore Paper Company	07/27/90	26	16	
	3 Times per Day	30	63	
	06/15/92 – 06/19/92	33	58	
	06/29/92 – 07/03/92	32	60	
	01/11/93 – 01/12/93	25	59	3,900
	01/15/93 & 01/18/93			3,900
	10/06/93			2,900
	Average:	30	63	3,567
International Paper Company	12/17/91	26	50	
	01/31/92	31	47	
	02/24/92	29	55	
	03/31/92	26	60	
	04/13/92	24	58	
	12/11/92	26		
	01/11/93 – 01/12/93	20	55	
	01/11/93 – 01/12/93	24	57	2,800
	01/15/93 & 01/18/93			3,100
	10/14/93	48		3,700
	Average:	* 45	54	3,200
Mohawk Paper Mills	12/11/92	44		
	12/16/92	42		
	01/11/93 – 01/12/93	43	63	3,600
	01/15/93 & 01/18/93			3,000
	10/11/93	42		6,000
	Average:	43	63	4,200
TAGSONS Papers	01/30/91 – 01/31/91		75	8,000
	01/31/91 – 02/01/91		74	6,600
	Average:		74	7,300
Saratoga County Sewer District No. 1 & TAGSONS Papers	Daily	25	69	
	01/11/93 – 01/12/93	23	78	5,300
	01/15/93 & 01/18/93			6,100
	10/20/93	19		8,000
	Average:	25	69	6,467
* Assume 45% solids due to installation of new screw press.				

TCLP TEST RESULTS

PARAMETER	COTTRELL PAPER COMPANY	ENCORE PAPER COMPANY	INTERNATIONAL PAPER COMPANY	MOHAWK PAPER MILLS	TAGSONS PAPERS		SARATOGA COUNTY SEWER DISTRICT NO. 1
SLUDGE SAMPLING DATE	01/12/93	07/27/90	07/31/91	12/06/91	03/13/91	03/20/91	01/12/93
Arsenic	< 0.5 mg/l	< 0.05 mg/l	1.0 ug/l	0.001 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.5 mg/l
Barium	0.012 mg/l	0.7 mg/l	280 ug/l	0.9 mg/l	0.07 mg/l	0.01 mg/l	0.05 mg/l
Benzene	< 85 ug/l	< 5 ug/l	< 6.0 ug/l	0.001 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Cadmium	< 0.01 mg/l	< 0.01 mg/l	< 0.5 ug/l	0.02 mg/l	< 0.01 mg/l	< 0.01 mg/l	< 0.01 mg/l
Carbon Tetrachloride	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Chlordane	< 0.005 mg/l	< 0.02 mg/l	< 0.001 ug/l	< 0.0002 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Chlorobenzene	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Chloroform	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Chromium	< 0.05 mg/l	< 0.05 mg/l	30 ug/l	< 0.02 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.05 mg/l
o-Cresol		< 10 ug/l	< 10 ug/l	< 0.02 mg/l			
m-Cresol		< 10 ug/l	< 10 ug/l	< 0.02 mg/l			
p-Cresol		< 10 ug/l	< 10 ug/l	< 0.02 mg/l			
Cresol	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
2,4-D	< 2 mg/l	< 2 mg/l	< 0.2 ug/l	< 0.2 mg/l	< 2 mg/l	< 2 mg/l	< 2 mg/l
1,4-Dichlorobenzene	< 100 ug/l	< 160 ug/l	< 0.1 ug/l	0.01 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
1,2-Dichloroethane	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
1,1-Dichloroethylene	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
2,4-Dinitrotoluene	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Endrin	< 0.005 mg/l	< 0.008 mg/l	< 0.0006 ug/l	< 0.02 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Heptachlor	< 0.005 mg/l	< 0.004 mg/l	< 0.0006 ug/l	< 0.0002 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Heptachlor Epoxide	< 0.005 mg/l	< 0.004 mg/l	< 0.0006 ug/l	0.001 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Hexachlorobenzene	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Hexachlorobutadiene	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Hexachloroethane	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Lead	< 0.5 mg/l	< 0.5 mg/l	19 ug/l	< 0.1 mg/l	< 0.5 mg/l	< 0.5 mg/l	< 0.5 mg/l
Lindane	< 0.005 mg/l	< 0.004 mg/l		< 0.0002 mg/l	< 0.005 mg/l	< 0.005 mg/l	< 0.005 mg/l
Mercury	< 0.02 mg/l	< 0.05 mg/l	< 1.0 ug/l	< 0.001 mg/l	< 0.02 mg/l	< 0.02 mg/l	< 0.02 mg/l
Methoxychlor	< 0.05 mg/l	< 0.04 mg/l	< 0.5 ug/l	< 0.0002 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.05 mg/l
Methyl Ethyl Ketone	< 170 ug/l	< 10 ug/l	< 10 ug/l	< 0.001 mg/l	< 10 ug/l	< 10 ug/l	< 710 ug/l
Nitrobenzene	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Pentachlorophenol	< 500 ug/l	< 790 ug/l	< 50 ug/l	< 0.02 mg/l	< 500 ug/l	< 500 ug/l	< 500 ug/l
Pyridine	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
Selenium	< 0.1 mg/l	< 0.05 mg/l	4.0 ug/l	< 0.002 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.1 mg/l
Silver	< 0.02 mg/l	< 0.02 mg/l	1.0 ug/l	0.03 mg/l	< 0.02 mg/l	< 0.02 mg/l	< 0.02 mg/l
Tetrachlorethylene	< 85 ug/l	< 5 ug/l	< 6.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
Toxaphene	< 0.05 mg/l	< 0.08 mg/l	< 0.05 ug/l	< 0.001 mg/l	< 0.05 mg/l	< 0.05 mg/l	< 0.05 mg/l
Trichlorethylene	< 85 ug/l	< 5 ug/l	< 5.0 ug/l	< 0.0005 mg/l	< 5 ug/l	< 5 ug/l	< 85 ug/l
2,4,5-Trichlorophenol	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
2,4,6-Trichlorophenol	< 100 ug/l	< 160 ug/l	< 10 ug/l	< 0.02 mg/l	< 100 ug/l	< 100 ug/l	< 100 ug/l
2,4,5-TP (Silvex)	< 0.2 mg/l	< 0.2 mg/l	< 0.05 ug/l	< 0.02 mg/l	< 0.2 mg/l	< 0.2 mg/l	< 0.2 mg/l
Vinyl Chloride	< 170 ug/l	< 10 ug/l	< 10 ug/l	< 0.0005 mg/l	< 10 ug/l	< 10 ug/l	< 170 ug/l

SUMMARY OF
NYSDEC PART 360-3.5D ASH REGULATION METALS
TEST RESULTS

PARAMETER	SLUDGE ANALYSIS (mg/kg)	TCLP EXTRACT (mg/l)
Antimony	< 3	< 0.06
Arsenic	< 0.25	< 0.5
Beryllium	< 0.25	< 0.005
Barium	9.7	0.14
Cadmium	0.54	< 0.01
Chromium, Total	1.05	< 0.05
Chromium, Hexavalent	< 0.1	< 0.1
Copper	17.9	< 0.05
Lead	< 5	< 0.5
Mercury	< 0.02	< 0.02
Nickel	< 2.5	< 0.05
Selenium	< 0.25	< 0.1
Silver	< 1	< 0.02
Thallium	< 0.5	< 0.025
Zinc	33.0	< 0.09
Calcium	14,800	450
Iron	164	< 0.01
Silicon	122	2.05
Tin	1.8	< 0.05
Aluminum	1,080	0.54
Chloride	120	18
Sulfate	78	3

SUMMARY OF CHLORIDE TEST RESULTS		
PARTICIPANT	SAMPLE DATE	CHLORIDE (mg/kg)
Cottrell Paper Company	10/11/93	< 59,000
Encore Paper Company	10/06/93	1,200
International Paper Company	10/14/93	< 100
Mohawk Paper Mills	10/11/93	< 240
TAGSONS Papers & Saratoga County Sewer District No. 1	10/20/93	4,700

APPENDIX F
LITERATURE RESEARCH

LITERATURE RESEARCH

As part of the evaluation of sludge management and energy recovery systems, a thorough literature examination was performed to identify emerging technologies that could be employed to optimize co-combustion systems. The following summarizes the literature research.

Carl E. Linderoth, "Paper Mill Sludge as a Valuable Fuel," Tappi Energy Eng. Manage. Anthology, 89, 1991.

This article states that paper mills should consider using their sludge as fuel for steam generation and fuel-drying operations. The main problem identified for using paper mill sludge as fuel is the dewatered sludge's high moisture content (typically 60 to 85%). All water introduced into the furnace must be evaporated and heated to the final stack temperature. Thus, any increase in fuel moisture content will decrease boiler efficiency and will require higher excess air levels to maintain stable, smoke-free combustion. If the mill has an existing grate-equipped boiler, mechanical dewatering might be sufficient, assuming the boiler has additional firing capacity on its grate and the resultant reduction in boiler efficiency is acceptable. If that is not the case, the performance of the boiler can be enhanced by pre-drying the sludge using waste heat in the boiler flue gases. If the mill does not have a grate-equipped boiler, the sludge can be burned in suspension in other types of boilers by utilizing a dedicated drying system to reduce moisture to below 10%. If this is still not efficient, the mill should consider drying the sludge in a stand-alone system where the necessary drying heat is generated by burning a portion of the dried sludge in suspension. In conclusion, the article states that paper mills should consider the potential cost savings of using paper mill sludge as a fuel versus the costs of landfill trucking, handling, and tipping fees.

Malcolm Pirnie, Inc., New York Paper Industry Solid Waste Characterization, Special Study Report, Project No. 1182-01-1, June 1988.

The purpose of this study was to assemble a data base of New York State paper industry manufacturing-derived wastes to provide a characterization of actual and projected paper industry landfill leachate. Forty-nine samples of wastewater, leachate, ground water, and solid wastes were collected from 19 paper mills encompassing over 54% of the estimated solid waste stream produced by the industry in New York. All samples were analyzed for the NYSDEC's Baseline Ground Water Quality Parameters and the Toxicity Characteristics Leaching Procedures (TCLP) parameters. Conclusions of the report were: a) none of the

paper industry sludges analyzed would be considered hazardous based on analysis of the TCLP extracts of the sludges; b) paper industry waste is uniform in its characteristics; and c) only four "parameters-of-interest" were identified in a comparison of TCLP sludge extract data to existing ground water quality standards (iron, managanese, toluene, and phenol).

C.T. Donovan Associates, Waste Wood Resource Supply Assessment, Final Report, Prepared for the New York State Energy Reasearch and Development Authority, Project No. 1416-ER-IHR-90, August 1991.

This report documents and analyzes the availability, supply, and price of wood waste in New York State to determine the types and amounts of wood waste currently generated and to estimate the potential for using it for fuel in the future. The report states that in 1989, over 11.78 million tons of wood waste was generated in New York State. Of this total amount, approximately 3.78 millions tons of wood waste was reused for fuel and other purposes. The report states that more than 25.7 million tons of wood waste could be available annually for fuel. Depending on the moisture content, this is enough wood to generate from 2,000 to 2,500 MW of power. In general, it was found that wood fuel prices depend on the type of fuel, moisture content, other uses for the resource, and market conditions at the time of purchase.

Franklin J. DiMascio and Peter A. Burrowes, "Thermal Dryer Dewater Solids," Water Environment & Technology, September 1993, p. 74.

To reduce costs, the Buffalo New York Sewer Authority added an indirect thermal dryer to its Bird Island sewage treatment plant to dewater sludge prior to incineration. Before the thermal dryer was installed, approximately 47 dry tons of solids were dewatered by four belt filter presses to an average cake solids of approximately 16% and conveyed to any two of three multiple-hearth incinerators for final reduction. Based on the sludge's high moisture content, two incinerators were normally required. The need to continually operate two incinerators at less than full capacity was both inefficient and uneconomical. Consequently, the Authority investigated using an indirect-heated sludge dryer to dewater a portion of the dewatered sludge to a solids content of approximately 26%, so that all of the plant's solids could be processed through one incinerator. The exhaust vapor from the dryer is condensed in a heat exchanger. A small induction blower draws noncondensable gases from the system downstream from the condenser and sends the gases to the multiple-hearth incinerators as combustion air.

In the first 3 months of operation, the dryer was operated with less than 5% down-time. The cost of the indirect thermal dryer system, including construction and equipment, was \$995,000. The plant has not attempted to process all of its solids through one incinerator since the physical arrangement of the existing

solids handling system does not allow effective blending of mechanically dewatered and thermally dewatered solids. Based on the performance of the dryer, it was determined that all solids could be fed to one incinerator. When the plant switches to a single incinerator operation, it is estimated that natural gas costs will be reduced by about 20 %. It is believed that increased electrical energy costs of the thermal dewatering system will be offset by reduced electrical energy use of the incinerator and reduced maintenance costs for operating only one incinerator.

Basic Engineering Inc., "New Use of Incinerator Cuts Cost of Sludge Drying," Public Works, October 1983.

Georgia Water Authority's Clayton County Flint River wastewater treatment plant uses an incinerator fueled with dry sludge pellets, pine wood chips, or both to provide heat for drying wet sludge into pellets. This is believed to be the first application of an incinerator that burns dry sludge to provide heat for sludge dryers, and the first application in which wood harvested from a land application area is burned for heat recovery purposes at a sewage treatment plant. The plant treats 15 mgd and was originally designed with a sludge drying and pelletizing system to convert sludge into a saleable product. During the construction of this system, the costs of natural gas and fuel oil to be used in the sludge dryer burner assemblies more than tripled. As a result, the Authority investigated burning sludge pellets as fuel to dry the wet sludge. The incinerator came on-line in October 1982. At startup, a market for sludge pellets had developed, and wood chips became available from the Authority's managed pine plantation. Thus, the incinerator feed system was modified to burn wood chips as the primary fuel, except when sludge pellet sales do not keep pace with production.

The following is a description of the system. Sludge from wastewater treatment is thickened and blended with polymer to achieve full flocculation. Sludge is dewatered on belt filter presses, discharged into storage, and conveyed to a paddle mixer, which mixes the sludge with previously dried sludge. The sludge cake mixture enters one of two parallel drying systems consisting of a rotary dryer, rotary cooler, dropout box, conveyor leading to a 440-ton dry storage bin, cyclone separator for removing fine sludge particles, and a wet scrubber for final pollution control. The combined incinerator-pelletizer system, operating in tandem, easily met air emission standards set by the Georgia Department of Natural Resources. The incinerator is a standard 24-million Btu/hr Basic Environmental Engineering Model 3000 mass burning furnace equipped with two hearths in series. The use of wood chips versus sludge pellets as fuel is based on the market economics of the pellets as a soil conditioner. Based on the article, the reliability of both the incinerator and pelletizing equipment has been excellent, with no failures or loss of on-line operating

time. The incinerator and appurtenances cost \$12.2 million, and were 75% financed by a U.S. Environmental Protection Agency grant.

Nadim Shamat and Joanne Hart, "Dewatering and Incinerating Wastewater Solids," Water Environment & Technology, October 1992, p. 62.

The solids processing and incineration-energy recovery system at the Metropolitan Waste Control Commission wastewater treatment plant in St. Paul, Minnesota, consists of innovative processes, including two types of solids dewatering devices (twin-roll filter presses and plate-and-frame diaphragm filter presses) and six multiple-hearth incinerators. Four of the incinerators are equipped with energy recovery-boilers, an economizer, heat wheels, and rotary solids dryers. Since the system began operating in 1983, the plant has been operating efficiently, meeting all Minnesota and federal effluent and emissions standards. The boilers are an integral part of the flue gas structure. They are essentially water-in-tube heat exchangers with an upper and lower drum. The unit has bare tubes and soot blowers at critical locations. In 1985, an economizer was installed downstream from the boiler to recover additional heat from the flue gas. The energy recovery-boiler economizer system uses the heat in the flue gas to generate 425 psi steam. The gas enters the boiler at 1150°F and leaves the economizer at 350°F. The nominal capacity of each boiler is 17,000 lb/hr of steam with a maximum output of 20,000 lb/hr. The steam produced from the boilers is used to heat the plant, to run pumps and induced-draft fans, and to accommodate the solids heat-treatment process needs.

NCASI, "Full-Scale Experience with the Use of Screw Presses for Sludge Dewatering in the Paper Industry," NCASI Tech. Bull. No. 612, NY, NY, 1991.

In 1990, the National Council of the Paper Industry for Air and Stream Improvement, Inc. (NCASI) conducted a survey of companies operating screw presses. The survey solicited information regarding screw press performance, design characteristics, preventative maintenance and repair, polymer usage, and pilot-scale to full-scale performance comparisons. Twenty-eight paper mills operating 61 full-scale screw presses from four manufacturers responded to the survey. A review of the data showed that the screw presses produce significantly higher cake consistencies than previous dewatering equipment. Average cake consistency was 42%, with extremes varying from 35 to 50%. Throughput varied from 3 to 60 dry tons per day per press. Average polyelectrolyte dosage was 15 lb/ton. Average operator attention time per shift was 2 hours. Instrumentation and control of the screw presses varied significantly among the respondents. Full-scale cake consistency was an average of nine percentage points lower than that achieved during the

pilot tests. Eighty-nine percent of the respondents reported that screw presses required less general maintenance than other dewatering equipment.

Brian D. Meckel, "Solids Converted to Energy at Paper Mill," Water Environment & Technology, May 1993, p. 15.

Inland Empire Paper Company of Spokane, Washington, has the first fluidized-bed incineration system designed to fire 100% paper sludge for energy recovery. Inland produces 260 tons of newsprint per day. The sludge processing unit, designed to handle 70 wet tons/day, is the first of its kind to generate hot water fueled only with paper and de-inking sludge mixtures. The hot water is used in the recycled paper de-inking process at a rate of approximately 600 gpm.

The following is a description of the system. After dewatering by a screw press, the primary solids and de-inked solids are discharged into a live-bottom metering bin before being sent to the combustor. Dolomite is added to reduce acid gas emissions. Metered solids enter the fluidized-bed incinerator through a pneumatic transport line. Combustion air is supplied through distribution headers and fluidization nozzles in the combustor cell. Before solids are introduced, the sand bed is heated with natural gas burners to a temperature beyond the flash point of the solids. A slide gate at the bottom of the combustion cell opens on a timed basis discharging sand and noncombustible material, which segregate on a vibrating screen. The bed sand is returned to the combustion cell by a bucket elevator; noncombustible material is collected for disposal. A natural gas burner over the combustion bed aids combustion. A closed-loop hot water heater removes up to 12.1×10^6 kJ/hr from the flue gas. Treated water supplies a process water heat exchanger. Water is heated to 120°F for the de-inking process. A shell-and-tube air preheater receives flue gas at 625°F and supplies 400°F fluidization air for improved combustion in the incinerator. In a baghouse, more than 99.5% of the particulates are removed from the flue gas. A pneumatic conveyance system removes ash for disposal. Clean flue gas is exhausted from a common stack used by the plant boilers.

Nickull, O., et al., "Burning Mill Sludge in a Fluidized-Bed Incinerator and Waste Heat Recovery System. Ten Years of Successful Operation," Tappi Journal, 74, 3, 119, 1991.

In the late 1970s, the Lielhti sulfite mill of G.A. Serlachius Corp. investigated alternative methods of sludge treatment. The mill had an annual capacity of 100,000 tons of bleached pulp, generated 80,000 tons of by-product lignin sulfonates, and specialized in dissolving pulps. The mill attempted to burn the sludge in an existing bark/oil-fired boiler; however, they experienced uneven firing, with resultant poor

combustion and significant increases in grate maintenance. The mill then considered the possibility of incineration with energy recovery using supplementary combustible materials, including corrugated cardboard, paperboard, and wood waste from other mills within the company. The incineration/heat-recovery system chosen was a fluidized-bed incinerator followed by a forced-circulation waste-heat boiler. The incinerator incorporates a hot windbox with an air preheater for start-up. Four in-bed oil guns provide auxiliary fuel when high-moisture-content feed is being burned. Waste fuels are top fed into the incinerator. Fluidizing air is provided through the windbox, while secondary air is injected above the bed.

At the plant, sludge is dewatered to 30 to 35% solids using v-disc presses and is stored in a live-bottom bin. Waste from outside sources is delivered by truck to an unloading hopper. The material is passed through a hammer mill before proceeding to the live-bottom bin. Sludge and the higher-Btu waste are fed by screw dischargers to a mixing conveyor and elevator and transported to the incinerator through an air-lock screw. Installation of the system was completed in 1980.

Despite a number of changes in mill configuration, mill operating procedures, and type of waste fuels fed to the incinerator, the system has proved to be efficient, reliable, and economical. Average steam production has surpassed 7,000 kg/hr, limited somewhat by the availability of waste fuel. Average annual operation during periods when the mill was operational has been more than 8,000 hr/year. System availability has exceeded 95%. Maintenance has been low, on the order of 1 to 3% of the initial installed capital cost per annum, with most of the maintenance cost associated with the feed-handling system. Staffing requirements have been low, essentially one person per shift. When the incinerator/waste-heat-recovery system was installed in 1980, the total investment in plant and auxiliaries was \$3,500,000.

Zimpro/Passavant, "Solids Flow Fluidly at Oneida County," Reactor, No. 60, June 1987.

The Oneida County Sewer District upgraded its activated sludge treatment plant from 27 to 48 mgd and installed a fluidized-bed incinerator designed to process 1,670 dry lb/hr of chemically conditioned sludge, dewatered to between 20 and 27% solids. Sludge is delivered to the furnace via two progressive cavity pumps. Inside diameter of the furnace is 14 feet, and the fluidizing air blower capacity is 4,000 scfm. An oil-fired preheat burner generates 4.5 million Btu/hr during start-up. Bed temperature runs between 1300°F and 1400°F. Spent air passes through a venturi and an impingement tray scrubber prior to stack discharge. Furnace off-gas passes through a vertical, multiple tube-and-shell heat exchanger where incoming combustion air is pre-heated. Following that, the off-gas continues on to an economizer, where additional energy is recovered. Over 4 million Btu/hr is transferred to a circulating hot water loop, which is used for building heating during cold weather. The economizer is a vertical, multiple tube-and-shell unit.

Sludge Incineration: Thermal Destruction of Residues, Water Environment Federation Manual of Practice FD-19, Alexandria, VA, 1992, p. 241.

Duffin Creek, Toronto, Canada sludge combustion and energy recovery system consists of two parallel trains of fluidized-bed combustors, each rated at 67,000,000 Btu/hr. The fluidized-bed incinerators are designed to operate either as cold or hot windbox units. The exhaust gas-to-air heat exchanger is piped so that it can either be bypassed, or part or all of the reactor hot gases can flow through the heat exchanger. As a result, the fluidizing combustion air to the reactor can be controlled from a compressed air temperature of 140°F, with no air preheating when burning drier sludges, and up to a maximum air preheat of 1150°F when burning wetter sludges. The water-tube boilers are each rated for 28,100 lb/hr at 275 psi. Part of the steam generated in the water tube waste-heat boiler is used in a turbine to power the 650-hp turbine drives on the fluidizing air blowers. The balance of the steam is used to process steam and heat the building. Dewatered ash is blended with dry ash from waste-heat boiler dust hoppers to produce a damp ash material that is trucked to a landfill. The design basis for the fluidized-bed combustors was as follows: total dry solids/reactor, 9,600 lb/hr; volatile solids, 76.6% total solids; heating value, 9,130 Btu/lb volatile solids; and sludge feed moisture, 70%. Combustion operating conditions were as follows: reactor exhaust gas temperature, 1580°F; percent of stoichiometric air, 135%; air preheat temperature, 740°F; and auxiliary fuel, 0.

Kleinhenz, N.J., and Smith, G., Evaluation of a Fluidized-Bed Sewage Sludge Incinerator Using Wood Chips for Fuel, EPA/600/52-86/044, U.S. EPA, Water Eng. Res. Lab., Cincinnati, Ohio, 1986.

The Western Lake Superior Sanitary District provides wastewater treatment (44 mgd) and solid waste disposal (280 tons per day) for the 500-square-mile area surrounding Duluth, Minnesota. The plant was completed in 1979, and includes an incineration facility, which was designed to use shredded solid waste as fuel to augment the combustion of sewage sludge in one of two fluidized-bed combustors, each rated at 100 MBtu/hr and having a 21-ft bed diameter. The plant experienced major difficulties with the solid waste processing system, and, in the absence of refuse-derived fuel, wood and bark chips were used as auxiliary fuel.

A major portion of the energy to operate the plant is provided by a waste-heat boiler that produces steam from energy in the hot combustion gases. Flue gases from the fluidized-bed incinerators pass through hot gas cyclones to effect fly ash removal. The hot flue gas (approximately 1600°F) then enters a waste-heat boiler where energy is recovered to produce steam. Additional fly ash is collected from the boiler and deposited in the same hopper as that collected from the cyclones. The temperature of the flue gas is

reduced to approximately 450°F before it passes through the venturi scrubbers and to 80 to 100°F as it passes through the secondary scrubber. The induced-draft fan imparts energy to the gas with a resultant increase in temperature to 125°F, and a heat exchanger further increases the gas temperature to approximately 220°F prior to discharge out of the stack.

The report investigated the stack particulate emissions and, especially, the metal content of the particulate emissions and of the various influent and effluent streams to the combustor scrubber system. The scrubber operates in a recycle mode taking makeup water from the treatment plant and discharging the scrubber effluent to the treatment system. It is conceivable that metals picked up in the scrubber water could, when returned to the treatment plant, have a toxic or inhibitory impact on the biological processes. Thus, the fate of metals in the process became the focus of the report.

In the majority of test runs, 50% or more of the input elements were removed in the fly ash. The sulfur content of the fly ash was low, on the order of 8%. However, the scrubber effects removal of approximately 49% of the system's sulfur input. Other elements were removed in the scrubber but to a lesser extent. The stack emissions, when compared to the total input, appeared insignificant. In conclusion, the study stated that under similar operating condition, it is unlikely that zinc or other metals with similar solubility characteristics would accumulate in the treatment plant sludge, subsequently be recycled to the incinerator, and then be returned to the treatment plant via the scrubber water in sufficient quantities to be detrimental to the biomass.

Richard B. Zang, Energy from Municipal Wastes - Fluidized-bed Combustion Systems, Dorr-Oliver, Inc.

On June 13, 1985, Kansas City became the first city with a system capable of producing electricity to operate a sewage treatment plant from wastewater sludge. Solid-bowl centrifuges dewater sludge for combustion in two 14-ft diameter fluidized-bed combustors. Two waste-heat boilers rated at 19,000 lb/hr provide steam at 250 psig to operate a 1000-kW generating system. Excess electricity during peak production can be channeled back to the City's power grid.

Gray, D.H., and Penesis, C., "Engineering Properties of Sludge Ash." J. Water Pollut. Control Fed., 44, 847, 1972.

The engineering properties of ash samples from seven wastewater treatment plants were evaluated. The seven plants included: Pontiac, Mich.; St. Paul, Minn.; Kansas City, Mo.; Saginaw, Mich.; So. Tahoe, Calif.; Cuyahoga, Ohio; Cromwell, Conn.; and Ann Arbor, Mich. The ashes were dry compacted using

standard procedures and exhibited widely varying, unconfined strength characteristics. The cement stabilization results demonstrated that ash would generally have good properties using as low as 6% (1.3 bag cement/Mg) cement-to-ash ratio. Frost heave studies were conducted on four of the ash samples with generally favorable results at a 4 to 6% cement-to-ash ratio. Thus, the cement-aided ash would develop strengths adequate for subbases and structural fills.

Gerlich, J.W., and Rockwell, M.D., Pressure Filtration of Waste Water Sludge with Ash Filter Aid. EPA-R2-73-121, U.S. EPA, Off. Res. and Dev., Cincinnati, Ohio, 1973.

Sludge ash characteristics were compared to fly ash from a coal power plant. The investigation found considerable differences between ash particle sizes. While the analysis indicated that the fly ash was finer in particle size, the photomicrographs showed that the fly ash appears to be larger and more spherical in physical structure.

Joo-Hwa Tay and Anthony T. C. Goh, "Engineering Properties of Incinerator Residue," Journal of Environmental Engineering, Volume 117, No. 2, Mar/Apr 1991.

After incineration of solid-waste, about 20% by weight of ash and other residues are produced. Both the washed clinker and fly ash collected from the incineration plant have the prerequisite properties for use in geotechnical application. The washed clinker is essentially a granular material of irregular shape. Fly ash is predominantly silt-sized, spherical particles. Both materials exhibit high strength and are relatively free-draining, typical of granular materials. The fly ash could be used as an admixture in the stabilization of soft soil. The clay samples treated with fly ash show substantially improved shear strengths and lower compressive properties.

Eric Trauner, "Sludge Ash Bricks Fired to Above and Below Ash-Vitrifying Temperature," Journal of Environmental Engineering, Vol 119, No. 3, May/June 1993.

The City of Indianapolis' Belmont advanced wastewater treatment plant produces 32 dry metric tonnes per day of ash from incineration of municipal wastewater sludge. Available capacity at the existing ash disposal site is limited. To determine the feasibility of an alternate disposal method, a bench-scale study was conducted to determine the physical characteristics of bricks produced at four ratios of clay content to ash content and fired to temperatures above and below the vitrification temperature of the ash. The use of sewage sludge ash as an admixture in brick appeared to be promising, especially when the ash amended

bricks were fired to above ash vitrification temperature. The City of Indianapolis and an Indianapolis-area brickmaker are preparing for a full-scale demonstration run.

Thomas S. Ewing and Lynn B. Di Tullio, "Using Small Steam-Turbine-Generator Sets to Replace Pressure-Reducing Valves," Tappi Journal, September, 1992, p. 107.

The article states that using a back-pressure turbine in a co-generation application is one of the most efficient ways of producing electricity. Paper mills should consider replacing steam pressure-reducing valves with steam-turbine cogeneration systems. The current availability of packaged turbine-generator systems makes them easy to implement, and they can be used to replace pressure-reducing valves in applications with steam flows as low as 4,000 lb/hr. Based on current prices for gas and oil, these systems can produce electricity for \$0.01 to 0.02/kWh. System costs range from \$200 to \$800/kW of capacity, and simple system paybacks between 1 and 3 years are common.

Camp Dresser & McKee, Natural Gas-Fired Superheating of Steam from MSW Energy Recovery Facilities, Final Report prepared for the New York State Energy Research and Development Authority, Project No. 1001-ERER-MW-88, July 1989.

This report studied the use of separately fired superheaters in conjunction with municipal solid waste-(MSW) fired incinerators/boilers. The objective of the study was to determine the technical and economic feasibility of a waste-to-energy plant with an external separately fired superheater to superheat saturated steam from a conventional municipal solid waste fired boiler. The study showed that the economics of new municipal solid waste-fired energy recovery plants can be improved substantially by the use of separate gas-fired superheaters. The concept consists of using a separately fired superheater to raise steam temperatures to central station pressures of 1000°F, and modifying the waste-fired boiler to generate saturated steam at central station pressures of up to 1800 psig. In addition to economic advantages, the concept also has an environmental advantage in that it reduces ground-level concentrations of pollutants by 12.5% when combining the stack gases from the MSW-fired boiler with the gas-fired superheater.

APPENDIX G

PRELIMINARY COST ESTIMATES

PRELIMINARY COST ESTIMATES

ITEM	FACILITY WITHOUT WOOD			FACILITY WITH WOOD		
	QUANTITY	UNIT COST	TOTAL COST	QUANTITY	UNIT COST	TOTAL COST
CAPITAL COST:						
Live--Bottom Sludge Receiving Hoppers	4	\$127,500	\$510,000	4	\$127,500	\$510,000
Sludge Pump Station	LS	\$200,000	\$200,000	LS	\$200,000	\$200,000
Relocate Existing Belt Filter Presses	2	\$10,000	\$20,000	2	\$10,000	\$20,000
Screw Presses	2	\$300,000	\$600,000	2	\$300,000	\$600,000
Sludge Conveyor Systems	LS	\$170,000	\$170,000	LS	\$170,000	\$170,000
Fluidized--Bed Incineration System	2	\$3,885,000	\$7,770,000	2	\$4,567,500	\$9,135,000
Wood Storage and Feed System	0	\$375,000	\$0	LS	\$375,000	\$375,000
Ash Slurry Pumps	2	\$15,000	\$30,000	2	\$15,000	\$30,000
Ash Conveyor	1	\$35,000	\$35,000	1	\$35,000	\$35,000
Ash Storage	1	\$100,000	\$100,000	1	\$100,000	\$100,000
Sludge Management Building	LS	\$630,000	\$630,000	LS	\$637,500	\$637,500
Yard Piping and Pumps	LS	\$340,000	\$340,000	LS	\$340,000	\$340,000
Site Work	LS	\$300,000	\$300,000	LS	\$300,000	\$300,000
Sludge Storage Pole Barn	LS	\$80,000	\$80,000	LS	\$80,000	\$80,000
Front End Loader	1	\$85,000	\$85,000	1	\$85,000	\$85,000
Truck Weigh Station	1	\$50,000	\$50,000	1	\$50,000	\$50,000
Stand-by Boiler	1	\$180,000	\$180,000	1	\$180,000	\$180,000
Ancillary Equipment	LS	\$150,000	\$150,000	LS	\$150,000	\$150,000
Piping & Mechanical Equipment	LS	\$150,000	\$150,000	LS	\$150,000	\$150,000
Feed Water System	LS	\$100,000	\$100,000	LS	\$100,000	\$100,000
Structural Improvements	LS	\$150,000	\$150,000	LS	\$150,000	\$150,000
Utility Improvements	LS	\$60,500	\$60,500	LS	\$60,500	\$60,500
Subtotal:			\$11,710,500			\$13,458,000
Contingencies:			\$1,171,050			\$1,345,800
Planning & Permitting:			\$644,078			\$740,190
Engineering, Legal, Fiscal, & Admin:			\$1,288,155			\$1,480,380
Land Acquisition:			\$100,000			\$100,000
Total Capital Cost:			\$14,913,783			\$17,124,370
ANNUAL DEBT SERVICE COST:			\$1,640,516			\$1,883,681
ANNUAL O&M COST:						
Waste Wood Chips / Pallets			\$0			\$371,425
Ash Disposal			\$375,950			\$386,900
Labor			\$540,000			\$570,000
Utility			\$1,603,150			\$616,800
Equipment Insurance			\$74,580			\$99,500
Testing and Monitoring			\$10,000			\$10,000
Chemicals			\$60,000			\$60,000
General Office Expense			\$10,000			\$10,000
General Maintenance			\$93,200			\$96,200
Water Supply and Wastewater Treatment			\$319,140			\$412,300
ANNUAL O&M COST:			\$3,086,020			\$2,633,125
TOTAL ANNUAL EXPENSES:			\$4,726,536			\$4,516,806
ANNUAL REVENUE:						
Sludge Tipping Fee			\$2,474,700			\$2,474,700
Steam Production			\$2,060,000			\$2,060,000
TOTAL ANNUAL REVENUE:			\$4,534,700			\$4,534,700
NET ANNUAL REVENUE:			(\$191,836)			\$17,894
LS = Lump Sum						

PRELIMINARY COST ESTIMATE ASSUMPTIONS

Capital Cost Estimate:

All construction cost estimates are based on manufacturer's data and Means 1993 Site Work Cost Data. Construction costs include equipment costs, freight costs, labor and installation costs, and contractor overhead and profit.

Live-Bottom Sludge Receiving Hoppers - Four hoppers to store 1 day's average production of paper mill sludge from Cottrell, Encore, IP, and Mohawk.

Sludge Pump Station - Two below-grade, cast-in-place concrete wet wells to store 1 day's average future production of sludge at approximately 4% solids from TAGSONS and the Sewer District.

Relocate Existing Belt Filter Presses - Installation cost to relocate the two existing belt filter presses and appurtenances from the County wastewater treatment plant to the proposed sludge co-combustion facility.

Screw Presses - Two screw presses to dewater Cottrell, Encore, TAGSONS, and the Sewer District's sludge from 20% solids to 45% solids.

Sludge Conveyor Systems - Convey dewatered sludge between processes.

Fluidized-Bed Incineration Systems - Includes reactors with refractory and insulation; feed system; startup system; over-temperature spray system; auxiliary fuel systems; fluidizing air blower and purge air system with associated motor drives; sand storage and feed system; heat recovery steam generator systems; venturi, separator and tray cooling systems; ash pump, ash thickener and vacuum filter system for ash dewatering; interconnecting duct and chutes; interconnecting piping and wiring; associated structural steel, platforming, stairs, and ladders; exhaust stack with continuous emission monitoring system; operational instrumentation and controls; and startup, commissioning, and performance test support.

Without wood (per incinerator, two incinerators total): reactor temperature = 1550°F, percent excess air = 40%, reactor diameter = 20 feet, No. 2 fuel oil requirement = 66

gallons per hour, venturi water = 113 gpm, cooling water = 267 gpm, installed reactor hp = 385 hp, steam production = 16,200 lb/hr at 600 psig.

With wood (per incinerator, two incinerators total): reactor temperature = 1550°F, percent excess air = 40%, reactor diameter = 21 feet, wood chip requirement = 2,120 lb/hr, venturi water = 134 gpm, cooling water = 315 gpm, installed reactor hp = 465 hp, steam production = 19,200 lb/hr at 600 psig.

Wood Storage and Feed System - Silo to store 1 week's average wood chip demand and conveying system from silo to incinerator feed system.

Ash Slurry Pumps - Two pumps (one operating, one standby) to pump ash slurry from scrubbers to the ash thickener.

Ash Conveyor - System to convey ash from the ash vacuum filter to ash storage.

Ash Storage - Store a maximum of 3 days of dewatered ash production.

Sludge Management Building - Sized to house all proposed equipment and administration and process control areas.

Yard Piping and Pumps - Includes water supply piping, wastewater piping, secondary effluent piping and pumps, and sludge piping and pumps.

Site Work - Includes site preparation, site grading, paving, landscaping, natural gas service, electric service, fencing, signs, excavating, dewatering, topsoil, and seeding.

Sludge Storage Pole Barn - Store a maximum of 5 day's of dewatered sludge from the participants.

Front End Loader - Transport sludge from the pole barn to the receiving hoppers.

Truck Weigh Station - Truck scale to weigh trucks entering the facility.

Standby Boiler - One natural gas-fired 25,000 lb/hr boiler to supplement the heat recovery steam generators to meet all of TAGSONS' steam demands.

Ancillary, Piping, and Mechanical Equipment - Includes steam piping, miscellaneous piping between mechanical equipment, and ancillary mechanical equipment such as flash tanks, deaerators, and condensate receivers.

Feedwater System - Includes all of the necessary pumps and piping to the three boilers.

Electrical Improvements - Includes electrical equipment for power distribution sequencing to feed the incoming service.

Water Treatment - Includes boiler makeup water supply and treatment facilities.

Contingencies - Based on a 10% construction contingency.

Planning & Permitting - Based on 5% of the total construction cost.

Engineering, Legal, Fiscal, & Administration - Based on 10% of the total construction cost.

Land Acquisition - Based on an assumed cost of \$100,000 for the three acres needed for the co-combustion facility.

Annual Debt Service Payment - First-year debt service payment is based on a bond issue in the amount of the total estimated construction cost, based on the 50%-rule of bond repayment and a 20-year bond term at an interest rate of 7.0%.

First-Year Annual Operation and Maintenance Cost Estimate:

Waste Wood Chips / Pallets - Based on \$20/ton including delivery.

Ash Disposal - Based on \$10/ton for ash trucking and disposal.

Labor - Includes all salaries and benefits for administrative personnel and facility staff.

Utility - Electric cost = \$0.0625/kWh; natural gas cost = \$0.47/therm, No. 2 fuel oil cost = \$0.85/gallon.

Equipment Insurance - Approximately 0.5% of the total construction cost.

Testing and Monitoring - Includes costs for all required testing and monitoring.

Chemicals - Includes the costs for all chemicals including coagulants.

General Office Expense - Includes the estimated costs for office supplies, telephone, photocopying, mailing, etc.

General Maintenance - Includes the anticipated cost of maintaining all process equipment, tankage, buildings, and amenities.

Water Supply and Wastewater Treatment - Includes the cost to purchase water from the City of Mechanicville at a cost of \$1.52/1,000 gallons, and includes the debt service cost and operation and maintenance cost for treatment at the expanded County wastewater treatment plant.

Revenue Estimate:

Sludge Tipping Fee Revenue - Based on \$50 per dry ton tipping fee (including all host fees).

Steam Revenue - Based on TAGSONS' avoided energy and water purchase costs for steam production.

Electric Revenue - Based on \$0.0625/kWh.

Net Revenue Estimate:

The first-year net revenue is the difference between the sum of the first-year debt service cost and annual operation and maintenance cost, and the estimated first-year revenue. The higher the estimated net revenue, the more economically feasible the project.

APPENDIX H

SUMMARY OF EXISTING NYSDEC

BENEFICIAL USE DETERMINATIONS FOR

MUNICIPAL SEWAGE SLUDGE, PAPER MILL SLUDGE, AND ASH

SUMMARY OF EXISTING NYSDEC BENEFICIAL USE DETERMINATIONS FOR
MUNICIPAL SLUDGE, PAPER MILL SLUDGE, & ASH

BUD NUMBER	NAME OF APPLICANT	WASTE TYPE	USE	DESCRIPTION OF PROCESS	NYSDEC ACTION DATE
012-7-34	Hydropress N-Viro Services, Inc.	Sludge	Soil	Land application of N-Viro soil (advanced stabilized sewage sludge).	05/17/90
014-5-46	International Paper, Corinth	Sludge	Soil	Blend of paper sludge with bark to use as a soil conditioner.	10/03/90
017-5-57	Encore Paper Company	Sludge	Cover, Grading	Use of paper mill sludge as daily cover, vegetative cover, intermediate cover, and grading material.	04/16/91
023-4-20	Lehigh Cement Company	Ash	Cement	Use of fly ash as a raw material in the manufacture of cement.	05/05/91
025-3-14	The Mearl Corporation	Sludge	Daily, Soil	Use wastewater treatment filter cake as top cover for land application.	09/19/90
035-7-12	Pozzolanic International	Ash	Concrete	Use of fly ash as cement substitute or aggregate in cement or concrete product.	10/11/89
039-7-34	Waste Stream Environmental, Inc.	Industry, Sludge	Agricultural	Cement kiln dust mixed with digested sludge from municipal sludge to produce N-Viro soil.	11/21/90
044-5-46	Mohawk Paper Mills, Inc.	Sludge	Paper Board	Solids from paper mill sludge used as feedstock for the production of multi-ply paper board.	05/14/91
048-4-20	Independent Cement Corp.	Ash	Cement	Use fly ash as a substitute for red shale in the production of cement. Supplied by Public Service Company of New Hampshire's Schiller facility.	06/13/91
050-9-15	Buffalo Crushed Stone, Inc.	Slag	Fill	Use blast furnace slag as road base, road subbase & chip and seal aggregate.	05/31/91
076-7-34	Niagara Mohawk Power Corp.	Ash	Flowable Fill	Use bottom ash and fly ash from Dunkirk Station and North Tonawanda Station as flowable fill.	07/22/91
084-4-20	Independent Cement Corp.	Sludge	Cement	The use of dewatered filter-press cake from paper mill sludge as a substitute for red shale in the manufacture of cement. Supplied by Mead Paper Co.	08/16/91
085-4-20	Independent Cement Corp.	Sludge	Cement	The use of dewatered filter-press cake from paper mill sludge as a substitute for red shale in the manufacture of cement. Supplied by Marcal Paper Mills.	08/16/91
086-4-20	Independent Cement Corp.	Sludge	Cement	The use of dewatered filter-press cake from magnesium hydroxide paste as a substitute for red shale in the manufacture of cement. Supplied by Reheis.	08/16/91
096-4-20	Independent Cement Corp.	Ash	Cement	The use of fly ash as a substitute for red shale in the manufacture of cement. Supplied by Pozzolanic International, Ithaca.	02/10/92
102-4-20	Independent Cement Corp.	Ash	Cement	The use of fly ash as a substitute for red shale in the manufacture of cement. Supplied by Cental Hudson Gas & Electric in Roseton, N.Y.	08/16/91

BUD NUMBER	NAME OF APPLICANT	WASTE TYPE	USE	DESCRIPTION OF PROCESS	NYSDEC ACTION DATE
113-6-23	Drum Ready Mix Company	Fly Ash	Concrete	Use fly ash from Fort Drum's coal-fired co-generation plant in the production of concrete mixes.	09/17/91
114-3-14	IBM East Fishkill Facility	Sludge	Cement	Transport electroplating/metal finishing sludge to Independent Cement Corporation, in Catskill, for use in making Portland cement.	07/30/91
120-0-00	NYSDEC-Division of Fish & Wildlife	Sludge	Land Spreading	Use fish hatchery sludge from 12 fish hatcheries across the state to spread on state land and farmland.	03/24/92
134-5-57	Stevens & Tompkins Paper Co.	Pulp	Cover, Grading	Use short fiber pulp residual from Stevens and Thompson Paper Co. for closure materials and daily cover of landfills.	03/27/92
146-4-20	Independent Cement Corp.	Fly Ash	Cement	Use fly ash from New England Power Corporation as a substitute for red shale to manufacture cement.	12/11/91
151-5-16	International Paper - Ticonderoga Mill	Sludge	Paper Products	Use primary paper sludge to manufacture non-food grade paper products.	02/07/91
162-4-20	Independent Cement Corp.	Sludge	Cement	Use wastewater treatment sediment supplied by Con Edison (Astoria Station) as an iron substitute in the manufacture of portland cement.	02/25/92
164-7-09	New York State Electric & Gas	Ash	Cement / Fill	Use coal fly ash from tire derived fuel, from Jennison Station, to manufacture cement, and as aggregate in concrete products.	04/03/92
165-7-09	New York State Electric & Gas	Ash	Traction Agent	Use coal bottom ash from tire derived fuel, from Jennison Station, as a traction agent on roadways.	02/06/92
170-5-16	International Paper - Ticonderoga Mill	Sludge	Daily Cover	Use primary paper mill sludge from Ticonderoga Mill as daily and final cover material.	09/22/93
176-6-25	Lyonsdale Energy Limited Partnership	Wood Ash	Fertilizer	Use wood ash from virgin and uncontaminated wood as fertilizer.	05/15/92
177-6-22	Union	Wood Ash	Fertilizer	Use wood ash from steam boilers as a soil supplement in composting and/or soil fertilizer.	05/29/92
182-4-29	Cranesville Block Co., Inc.	Ash	Concrete	Use fly ash from Central Hudson's Danskammer Power Plant as an ingredient in concrete products.	04/03/92
191-4-20	Lehigh Cement Company	Kaofin	Cement	Use Kaofin (residue from recycled magazines in production of tissue paper) from Marcal paper Mills, Inc. of Elwood Park, NJ to manufacture cement.	05/08/92
196-0-33	Champion International Corporation	Sludge	Cellusorb	Use paper mill wastewater treatment solids (filter cake) in the manufacture of Cellusorb, and absorbant product.	05/13/92
198-0-00	Generic wood ash BUD	Wood ash	Fertilizer	Use wood ash as fertilizer.	06/23/92

BUD NUMBER	NAME OF APPLICANT	WASTE TYPE	USE	DESCRIPTION OF PROCESS	NYSDEC ACTION DATE
199-8-08	Chemung County Sanitary Landfill	Foundry Sludge	Daily Cover	Use foundry sand and sewage sludge as daily cover at the Chemung County Landfill.	06/22/92
202-5-46	International Paper - Corinth Mill	Fiber Pulp	Pre-cast Bldgs	Use short fiber pulp residual from International paper Company, Hudson River Mill, for pre-cast building and construction systems and materials.	09/13/93
207-6-23	Fort Drum Heat Plant	Ash	Agricultural	Use ash from Fort Drum Heat Plant as an agricultural lime/fertilizer.	06/22/92
208-4-29	Cranesville Block Co., Inc.	Ash	Aggregate	Use fly ash as ingredient in lightweight concrete aggregate.	07/01/92
209-9-07	Jamestown Board of Public Utilities	Fly Ash	Concrete	Use fly ash from their coal fired power generating facility in the manufacture of ready mix concrete and flowable fill.	07/08/92
212-7-34	Niagra Mohawk Power Corp.	Bottom Ash	Asphalt	Use bottom ash to produce hot mix asphalt.	06/29/92
213-3-60	Westchester County	Sludge	Fertilizer	Use dried sludge from Yonkers Joint Treatment Plant and blend with fertilizer for use on trees, shrubbery, and flower beds.	09/09/92
215-3-53	World Envirotech, Inc.	Sludge	Asphalt	Use vitrified sewage sludge aggregate as a substitute for natural aggregate in the manufacture of asphalt/concrete products.	10/20/92
220-7-00	AgOrganic, Inc.	N-Viro	Liming Agent	Use N-Viro (dewatered sludge blended with cement kiln dust) as a liming agent on farms.	07/20/92
222-4-20	Independent Cement Corp.	Ash	Cement	Use ash from the incineration of paper sludge as substitute for red shale in the manufacture of cement. From Garden State Paper Co., Garfield, NJ.	09/14/92
240-7-09	New York State Electric & Gas	Ash	Cement	Use coal fly bottom ash as a raw material in the manufacture of cement.	10/22/93
262-9-15	Valley Coal	Ash	Road Material	Use coal bottom ash from Buffalo Municipal Housing Authority as fill and as road material.	01/21/93
265-4-20	Lehigh Cement Company	Ash	Cement	Use coal fly ash from Miller Brewing Company, Fulton, NY as a partial substitute for red shale in the manufacture of cement.	10/09/93
268-5-46	GE Silicones, Waterford	Ash & Sludge	Ash in Cement/Sludge in Asphalt	Use rotary kiln incinerator ash to manufacture cement and sludge to manufacture A-C hot mix asphalt.	11/09/93
272-1-52	Rolite, Inc.	Ash	Cover	Use ash that is processed into gray, well-graded aggregate with sand as daily cover, gas venting, and grading material at landfills.	12/20/93
281-5-16	International Paper - Ticonderoga Mill	Wood Storage	Fill	Use wood residue from pulpwood piles as fill and backfill with gravel	10/19/93
284-9-15	Niagra Mohawk Power Corp.	Ash	Fill	Use coal bottom ash as structural fill at Sonwill Project in West Seneca.	07/09/93
286-9-32	New York State Electric & Gas	Ash	Subbase	Use coal bottom ash from the Kintigh Station as road subbase.	07/19/93
305-6-23	Development Authority of North Country	Paper Mill Sludge	Daily Cover	Use paper mill sludge as daily cover at the landfill in Rodman.	07/30/93
325-4-01	Blue Circle Cement Inc.	Cement Kiln Dust	Misc.	Use cement kiln dust as liming agent, fertilizer, for landfill cover and closure and other uses.	10/25/93