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0738-7656

Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Attention: Mr. Jeffery Koerner, P.E.

RE: BUCKEYE FLORIDA, LIMITED PARTNERSHIP
AIR PERMIT APPLICATION NO. 1230001-023-AC/PSD-FL-397
MODIFICATION TO THE NOS. 1 AND 2 POWER BOILERS, NOS. 1 AND 2 BARK BOILERS, NOS. 2 AND 3 RECOVERY BOILERS, AND PULPING SYSTEM
REQUEST FOR ADDITIONAL INFORMATION NO. 2

Dear Mr. Koerner:

Buckeye Florida, Limited Partnership (Buckeye) has received the Department's (FDEP's) request for additional information (RAI) dated May 1, 2008, regarding the Foley Energy Independence Project. Each of the Department's requests is answered below, in the same order as they appear in the RAI letter.

Comment 1. As previously requested, please provide the details of the work to be performed on the Nos. 2 and 3 Recovery Boilers that will convert each unit to the Non-Direct Contact Evaporator design (ductwork, economizers, tubing, refractory, etc.)

Response 1: The Foley Energy Independence Project will convert the existing Nos. 2 and 3 Recovery Boilers to non-direct contact evaporator (NDCE) design from the existing direct contact evaporator (DCE) design. The objective of the project is to increase the system efficiency and increase the steam generation using the same fuel in the recovery boilers (i.e., black liquor, fuel oil, tall oil). The additional steam generated will be used to generate power in a new condensing turbine (CT) generator.

The quantity of black liquor solids fired in the two recovery boilers will not change from the existing firing rate. The improved efficiency will occur because the evaporation of the black liquor will no longer be accomplished using direct contact with flue gas at a 1:1 economy, but will be accomplished with external evaporation systems with a 4.2:1 economy. Also the heating value of the black liquor fuel will increase due to the elimination of black liquor oxidation. Black liquor oxidation causes partial oxidation of the liquor and a reduction of heating value of the fuel before it reaches the boilers.

To accomplish the project goals, the boilers will be modified and concentration systems will be added. When the direct contact evaporators are removed, additional will be contained in the flue gases entering the boilers. Therefore, additional heat transfer surface area will need to be added to the boilers to absorb the heat and produce steam. This will be accomplished by the installation of a new economizer on the No. 2 Recovery Boiler, which currently does not have an economizer, and installation of an additional economizer on the No. 3 Recovery Boiler, which currently has a small economizer, in order to increase the heat transfer surface area. Also, additional superheater surface area will be needed on both boilers to maintain steam temperature when the economizers are added.

No. 2 Recovery Boiler

The modifications on the No. 2 Recovery Boiler will include the following:

- Replacement or modification of the flue ducts from the generating section outlet to the cyclone evaporator outlet;
- Installation of a new economizer with new soot blowers;
- Increased superheater surface area;
- Installation of an ash collection system to collect the ash from the new economizer and ducts;
- Installation of a new mix tank in order to mix the ash into the black liquor; and
- Installation of a tertiary air fan.

Replacement/Modification of flue ducts – A new flue gas duct will be installed to connect the economizer inlet to the generating section outlet. New flue gas ducts will be installed from the economizer outlet to the cyclone evaporators. The cyclone evaporators will no longer function as evaporators, but will be modified and will function as flue gas ducts. The cyclone outlets will continue to be connected to the existing precipitator inlet.

No. 2 Recovery Boiler economizer – The new economizer for the No. 2 Recovery Boiler will be a horizontal economizer with approximately 68,500 linear feet of 2-inch diameter tubing. Also included in the economizer will be inlet and outlet headers for the feed water, casing, and support steel. Fifteen additional soot blowers will be added to the economizer to keep the surface area clean.

Additional superheater heat transfer surface area – Additional superheater heat transfer surface area will be added to maintain the steam temperature leaving the boiler at the same value as with the current operation. Maintaining superheater temperature is critical in order to optimize power generation in the condensing turbine generator. Eight additional rows of superheater tubes will be added for an increase in superheater surface area of approximately 20 percent.

Ash collection & Mix tanks – A new mix tank will be installed to allow mixing of the ash collected from the economizer and flue gas ducts. The tank will be 12 feet in diameter and 10 feet tall, with an overflow pipe at a height of 8.5 feet, resulting in a usable capacity of 7,200 gallons. Fifty-percent black liquor from an existing storage tank (east black liquor storage tank) will supply the existing No. 2 Recovery Boiler precipitator mix tank. This black liquor will be un-oxidized 50-percent black liquor as opposed to the 65-68 percent oxidized black liquor currently being supplied from the cyclone evaporator recirculation pumps. Black liquor in the precipitator mix tank will collect the ash from the precipitator and will flow by gravity to the new mix tank. The collected ash from the economizer and flue ducts will be conveyed by drag conveyors to the new mix tank. The black liquor in the new mix tank will be returned to the 50-percent black liquor storage tank after the ash is mixed into the liquor. A revised process flow diagram of the No. 2 Recovery Boiler, including the new mix tank and ash removal system, is provided in Figure 2-9 of Attachment A of this response.

Tertiary air fan – The additional heating value of the un-oxidized black liquor (approximately 7 percent) will require additional combustion air to be supplied to the boiler. The current combustion air fans are marginally sized, therefore additional combustion air capacity is required. A new tertiary air fan will supply ambient air to the boiler at the tertiary air elevation. The new tertiary air fan will be designed for approximately 123,000 pounds per hour (lb/hr), which will increase the total combustion air capacity by approximately 20 percent. This size fan is required, as all at the tertiary air elevation will be supplied by this fan.

Burners and burner pumps – No modifications will be made to the liquor burner pumps on the No. 2 Recovery Boiler, as the firing rate will be similar to the current black liquor firing rate. No modification will be made to the fossil fuel auxiliary burners, which will operate in the same capacity as they are currently operating.

No. 3 Recovery Boiler

The modifications to the No. 3 Recovery Boiler will be similar to the changes on the No. 2 Recovery Boiler, except for a few differences. Detailed technical information regarding the sizing of any new equipment for the No. 3 Recovery Boiler is currently unavailable, as the final engineering analysis is currently being performed, and the process of requesting quotes from manufacturers is also ongoing. The modifications to the No. 3 Recovery Boiler will include the following:

- Installation of an additional economizer;
- Installation of two new superheater platens;
- Installation of a new water coil air heater;
- Installation of new flue gas ducts; and
- Installation of a new ash collection system and a new ash mix tank to collect the ash from the new economizer and ducts.

No. 3 Recovery Boiler economizer – The No. 3 Recovery Boiler currently has a small economizer in service, which will remain in service as a result of this project. An additional economizer will be installed to recover the heat in the flue gases currently being used for evaporation in the cascade evaporator. The economizer will include additional heat transfer surface, inlet and outlet headers for the feed water, casing, and support steel. Also, additional soot blowers will be required, but the number of soot blowers is currently unknown.

Superheater platens – Two new superheater platens will be installed in the No. 3 Recovery Boiler superheater, which will increase the superheater heat transfer surface area by approximately 6 percent.

Water coil air heater – In addition to the installation of a new economizer, a new water coil air heater will be installed to preheat and increase the primary air temperature to the lower furnace of the No. 3 Recovery Boiler. This will reduce the temperature of the water leaving the new economizer before it enters the existing economizer. This change is required to prevent steam from being generated in the economizer (steaming economizer) which could cause vibration and boiler stability problems.

Installation of flue gas ducts – A new flue gas duct will be installed to connect the outlet of the existing economizer to the inlet of the new economizer. A new flue gas duct will also be installed from the outlet of the new economizer to the inlet of the existing electrostatic precipitator (ESP).

Ash collection & mix tanks – An ash collection system will be installed to collect the ash from the new economizer and flue gas ducts and mix the ash into the black liquor. The system on this boiler will be a sluice system where black liquor is pumped from the existing precipitator mix tank to sluice bowls located on the economizer and flue gas duct hopper outlets. Ash will mix with the black liquor in the sluice bowls and will return by gravity to the precipitator mix tank. A revised flow diagram of the proposed No. 3 Recovery Boiler, including the proposed ash sluice system, is provided in Figure 2-10 of Attachment A of this response.

Combustion air fans – The existing combustion air fans on the No. 3 Recovery Boiler are adequately sized to accommodate the increased heating value of the black liquor fuel, therefore no modifications are required for the fans.

Burners and burner pumps – No modifications will be made to the liquor burner pumps on the No. 3 Recovery Boiler, as the firing rate will be similar to the current black liquor firing rate. No modification will be made to the fossil fuel auxiliary burners, which will operate in the same capacity as they are currently operating.

Multiple Effect Evaporator (MEE) System

Because direct contact evaporation of black liquor using boiler flue gas will be eliminated, two new concentrator systems will be added to concentrate the black liquor to the appropriate concentration needed for firing in the boilers. The two concentrators, one for each recovery boiler, will be tied into an existing multiple effect black liquor evaporator. Each of the existing evaporator sets are five-effect units. The two concentrators will be identical in design, but each will operate at a slightly different rate based on the capability of the existing MEE unit that it is tied into.

Each concentrator will be a forced circulation/crystallizer type unit and will include the following:

- Two tube and shell heat exchangers;
- Two recirculation pumps;
- A crystallizer flash tank;
- A product flash tank; and
- A product transfer pump.

Steam will be supplied to the concentrator heat exchangers at a gauge pressure of 50 pounds per square inch (psi), and the concentrator will function as the first effect when tied to the existing evaporator train. The first and second effects of the existing evaporator will be tied together in a parallel configuration in the vapor flow path as opposed to the current series configuration. Therefore the two effects tied in parallel will become the second effect of the new concentrator/evaporator system. A revised flow diagram of the MEE system is provided in Figure 2-11 of Attachment A of this response.

Vapor from the concentrator crystallizer flash tank will supply the new system second effect (old first and second effects now in parallel). Vapor from the new system second effect will supply the existing third effect. The vapor flow path from the third effect to the condenser will remain the same as the current system.

Three external black liquor heaters will be added to each evaporator system to preheat liquor between effects. This additional heating surface for preheating black liquor will allow the internal heaters within the effects to be opened and function as evaporator surface area. An additional parallel auxiliary condenser will be added to the No. 3 black liquor evaporator to insure adequate condensing capacity. Miscellaneous piping and vapor duct changes will be required to tie in the new vapor flow and liquor flow configurations and to minimize vapor line pressure drop between effects. There may be minor pump upgrades to accommodate increased head requirements of the new design.

The new concentrator/evaporator systems will continue to operate with five-effect economy, with an expected economy of 4.2 pounds of evaporation per pound of steam supplied to the concentrator. The total evaporation capacity of the two new systems will be approximately 2 percent greater than the current total evaporation capacity of the two existing evaporator trains, the cyclone evaporator on the No. 2 Recovery Boiler, and the cascade evaporator on the No. 3 Recovery Boiler. The maximum black liquor solids throughput of the Nos. 2 and 3 MEEs will be 122,356 lb/hr and 127,350 lb/hr, respectively.

Comment 2. Describe in detail what is covered under "common system changes", as described in RAI response No. 2.c.1., last bullet. Regarding the reference to pumps, will there be any change-out of any fuel pumps? If yes, please provide a description and the displacement (gallons/hour) of the existing pump and the new pump.

Response 2: The common system items include project scope that is needed for both boilers. This includes an additional concentrated liquor storage tank with pumps and piping, pumps and piping to recover and mix boiler ash into the black liquor, and piping to allow transferring black liquor to the various tanks and equipment.

The operating concept on how to mix boiler ash with the black liquor will change significantly when the Foley Energy Independence Project is implemented. The storage of concentrated liquor and delivery of concentrated liquor to the recovery boilers will also change. There will be **NO CHANGE** to the black liquor fuel delivery to the burners (i.e. the boiler black liquor burner pumps supplying black liquor to the burners will not change on either recovery boiler).

Presently, the scope of "common system changes" includes the following items:

- Installation of a new concentrated black liquor storage tank;
- Installation of piping from the new concentrators to the new storage tank and/or the existing storage tank;
- Installation of piping from the concentrated liquor storage tanks to the recovery boiler salt cake mix tanks;
- Installation of a recirculation pump and piping on each concentrated liquor storage tank to minimize the potential for tank cone plugging;
- Installation of a transfer line between the new and existing concentrated liquor tanks;
- Installation of new pumps on the existing East 50-percent black liquor storage tank to circulate 50-percent liquor to the boilers for ash mixing; and
- Installation of pumps on the recovery boiler ash mix tanks to supply sluice systems and return the liquor to the East 50-percent storage tank.

When the Foley Energy Independence Project is implemented, the concentration of black liquor to the necessary firing concentration will no longer be coupled to recovery boiler operation. Black liquor concentration will occur in the concentrators, which will be coupled with evaporator operation. Therefore, concentrated black liquor storage is required to be able to operate the boilers when concentrator/evaporator systems are down for maintenance. The existing concentrated black liquor storage tank does not have enough surge capacity to allow the boilers to operate when a concentrator/evaporator system is down for routine maintenance or cleaning. A new concentrated black liquor storage tank will be added, sized such that the capacity of the existing tank and the new tank combined will allow the boilers to operate at full rate for up to 12 hours with one of the three 70-percent concentrator/evaporator systems (Nos. 2, 3, and 4 MEEs) down for maintenance.

Each concentrated black liquor storage tank will have three pumps. Two of the pumps will supply liquor to the boiler salt cake mix tanks and one pump will be dedicated to re-circulate liquor within the tank. The liquor transfer pumps (2 per tank) will each have a capacity of 332 gallons per minute (gpm). The recirculation pump (1 per tank) will have a capacity of 600 gpm. The normal expected operation is for the product from the existing No. 4 concentrator and the product from the new No. 3 concentrator to supply the existing concentrated liquor storage tank (West 70-percent storage tank) and for the new No. 2 concentrator to supply the new concentrated liquor storage tank (East 70-percent storage tank). The transfer pumps on the existing concentrated liquor storage tank (West

70-percent storage tank) will normally supply the No. 3 Recovery Boiler and the No. 4 Recovery Boiler (existing non-direct contact boiler) salt cake mix tanks. It is expected that both transfer pumps will normally be in operation. One transfer pump on the new concentrated liquor storage tank (East 70-percent storage tank) will supply liquor to the No. 2 Recovery Boiler. In addition, this pump will transfer a nominal amount of concentrated black liquor to the existing concentrated liquor storage tank (West 70-percent storage tank). The second pump will normally be down and will be available as an in-line spare. The recirculation pumps on each tank will circulate liquor from the side of the cone bottom and discharge into the bottom of the cone. This is expected to prevent solids from settling and collecting in the bottom of the cone.

The new operating concept for mixing boiler ash is to circulate 50-percent black liquor from the East 50-percent black liquor storage tank to the Nos. 2 and 3 Recovery Boilers to mix in the ash from the precipitators, economizer, generating section hoppers, and flue gas ducts. The liquor will be returned back to the East 50-percent black liquor storage tank. The two new concentrators will be supplied from the East 50-percent black liquor storage tank. This concept is being used because it is believed it is easier to mix the ash with the lower concentration liquor, and the forced circulation/crystallizer concentrators perform better if the liquor being evaporated contains suspended solids.

Two new pumps will be installed on the East 50-percent black liquor storage tank to be used in addition to the existing pumps to supply the concentrators and the boiler ash mix systems. One pump will have a capacity of 517 gpm, and the other pump will have a capacity of 300 gpm. Also, new piping will be installed for the supply of the concentrators and for the supply and return of liquor used in the boiler ash mix systems.

Fifty-percent black liquor from the East 50-percent black liquor storage tank will supply a new mix tank on the No. 2 Recovery Boiler. After ash has been mixed with the liquor, it will be returned to the East 50-percent black liquor storage tank. Two new pumps will be installed on the mix tank. Each pump will have a capacity of 300 gpm.

Fifty-percent black liquor from the East 50-percent black liquor storage tank will supply the existing precipitator mix tank on the No. 3 Recovery Boiler. Liquor will be supplied from the precipitator mix tank to the existing sluice hopper under the generating section and existing economizer of the boiler and to the sluice hoppers for the new economizer and flue gas ducts that are being added by the project. After ash has been mixed with the liquor, it will be returned to the East 50-percent black liquor storage tank. One new pump will be installed on the mix tank and two pumps will be upgraded. The new pump will have a capacity of 182 gpm, and the upgraded pumps will each have a capacity of 682 gpm. One of the upgraded pumps will be a stand-by pump. The smaller pump will return the liquor to the East 50-percent black liquor storage tank and the larger capacity pump will supply liquor to the multiple sluice points.

Comment 3. **Regarding contemporaneous emission changes discussed in RAI response No. 5, your comment is confusing. What is the previous permit number that Permit No. 1230001-018-AC revised and you did not include because it was outside of the contemporaneous 5-year period? Please describe when each project was completed.**

Response 3: The previous permit that Permit No. 1230001-018-AC revised is Permit No. 1230001-011-AC. Both of these permits contained tables with the net emissions changes based on the changes in the permit (see Attachment B). As shown, there were no changes in the total net emissions changes between Permit No. 1230001-011-AC and Permit No. 1230001-018-AC, except for values for total reduced sulfur (TRS) emissions. In Permit No. 1230001-011-AC there was a total net decrease in TRS emissions of 49.9 tons per year (TPY), while in Permit No. 1230001-018-AC

there was a total net decrease in TRS emissions of 48.9 TPY. While there was a slight increase in TRS emissions from Permit No. 1230001-011-AC to Permit No. 1230001-018-AC, there was still a significant decrease in TRS emissions as a result of the project. The emissions increases of sulfur dioxide (SO_2) and sulfuric acid mist (SAM) resulting from this project were granted a Pollution Control Project (PCP) exclusion pursuant to Rule 62-212.400(2)(a)2.b., F.A.C. Therefore, these emissions were not included in the total contemporaneous emissions increases in Tables 3-3 and 3-4. The changes outlined in Permit No. 1230001-011-AC were implemented by the end of 2001 and the beginning of 2002, with the No. 1 Power Boiler (EU 002) operating as a secondary noncondensible gas (NCG) and TRS control device.

Another project completed recently (early 2006) that was not included in the contemporaneous emissions changes was the upgrade of the No. 2 Brownstock Washing System in order to comply with the Kraft pulping standards of 40 CFR Part 63, Subpart S (MACT I) under Permit No. 1230001-014-AC (see Attachment B). The project resulted in significant emissions increases in SO_2, nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), particulate matter with a diameter of 10 microns or less (PM_{10}), and SAM. These emissions increases were also granted a PCP exclusion pursuant to Rule 62-212.400(2)(a)2.b., F.A.C. Therefore, these emissions were not included in the total contemporaneous emissions increases in Tables 3-3 and 3-4. The project also resulted in emission decreases in TRS and volatile organic compounds (VOC).

Tables 3-3 and 3-4 have been updated to reflect the emissions from Permit Nos. 1230001-018-AC and 1230001-014-AC; however, the PSD applicability analysis did not change as a result of these emissions, as described above. The updated Tables 3-3 and 3-4 have been included in Attachment C of this response.

Comment 4. **When the conversion of the No. 2 Recovery Boiler to low-odor design during Phase I is completed and a new black liquor concentrator installed, the total reduced sulfur (TRS) emissions collected by the noncondensible gas (NCG) system will increase, which will increase sulfur dioxide (SO_2) emissions when combusted. Why was the PSD netting analysis split into Phase I and Phase II? Why were the SO_2 emissions increases from the No. 1 Bark Boiler and No. 1 Power Boiler included in Phase II rather than Phase I?**

Response 4: The project has two phases and therefore the PSD applicability for each phase was assessed (i.e., determined whether the phase would result in a PSD significant emission rate increase in one or more pollutants). The changes in Phase I include conversion of the No. 2 Recovery Boiler from a DCE design to an NDCE design, and the installation of a new black liquor concentrator for the No. 2 Recovery Boiler. The changes in Phase II include conversion of the No. 3 Recovery Boiler from DCE design to NDCE design, installation of a new black liquor concentrator for the No. 3 Recovery Boiler, installation of a new condensing turbine generator, and increasing the amount of wood/bark purchased in order to increase the annual heat input to the Nos. 1 and 2 Bark Boilers. Therefore, both phases were evaluated separately for PSD applicability.

The increases in SO_2 emissions due to TRS and NCG destruction in the No. 1 Bark Boiler and the No. 1 Power Boiler were included in both Phase I and Phase II, however they were included under the heading of the black liquor concentrators. The purpose of this was to keep separate the emissions due to TRS/NCG burning and those due to fuel burning. Phase I included the new black liquor concentrator for the No. 2 Recovery Boiler, while Phase II includes the new black liquor concentrators for both the Nos. 2 and 3 Recovery Boilers. The No. 1 Bark Boiler and No. 1 Power Boiler will experience no changes in operation during Phase I, except for receiving additional TRS/NCG gases from the new black liquor concentrator for the No. 2 Recovery Boiler. Therefore,

only the increase in emissions from the TRS and NCG gas destruction from the new black liquor concentrator were included in Phase I.

SO_2 emission increases from the No. 1 Bark Boiler and No. 1 Power Boiler were included in Phase II because the fuel burning of these units will be affected in Phase II (i.e., greater bark burning and restrictions on fuel oil burning).

The emissions from the two proposed new black liquor concentrators, which will be captured and sent to the No. 1 Bark Boiler and the No. 1 Power Boiler for control and destruction, are included in the PSD applicability analysis shown in Table 3-3. The detailed calculations for the projected actual emissions for Phase I and Phase II were included in Tables 2-2 and 2-3.

Comment 5. **In the application and as reflected in Tables 2-1, 2-2, 2-3, 3-3 and 3-4, your PSD netting analysis was based on "baseline actual emissions" to "projected actual emissions". Baseline actual emissions are defined at Rule 62-210.200 (Definitions), F.A.C., as follows: "For an existing emissions unit (other than an electric utility steam generating unit), baseline actual emissions means the average rate, in tons per year, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding the date a complete permit application is received by the Department, except that the 10-year period shall not include any period earlier than November 15, 1990." It appears that your calculations used the actual sulfur content, by weight, of the fuel oil fired in 2002 (1.9%) and the consumption from the years 2004 and 2005. Based on Table A-6, the baseline years 2004 and 2005 lists the actual fuel sulfur contents, by weight, that were fired as 1.8% and 1.6%, respectively. Therefore, recalculate and submit the baseline actual emissions for SO_2 for each affected emissions unit using consistent years for the actual fuel consumption and actual fuel sulfur and make any adjustments to the affected tables and project proposal as necessary.**

Response 5: Of the tables referenced, only Tables 2-1, 3-3, and 3-4 contain the baseline actual emissions for SO_2. The baseline actual SO_2 emissions for units burning fuel oil were calculated in the Appendix A tables. The actual fuel usage from each year was used with the actual average annual sulfur content from the fuel oil used that year. For the years 1997 through 1999, the actual fuel oil sulfur content was not available, so the maximum permitted 2.5-percent sulfur content was used in those annual calculations. The actual annual average fuel oil sulfur content was used for the baseline actual calculations for the years 2000 through 2006. These fuel oil contents can be seen in Tables A-2 and A-6 for the No. 2 Recovery Boiler, Tables A-8 and A-12 for the No. 3 Recovery Boiler, Tables A-14 and A-17 for the No. 1 Power Boiler, Tables A-24 and A-28 for the No. 1 Bark Boiler, and Tables A-30 and A-34 for the No. 2 Bark Boiler. The baseline actual emissions were calculated correctly in accordance with Rule 62-210.200, F.A.C. For the year 2004, the sulfur content is 1.8 percent, and for 2005 it is 1.6 percent. The SO_2 emission factors reflect these sulfur contents.

Tables 2-2 and 2-3 contain the calculations for the projected actual emissions for Phase I and Phase II of the proposed Buckeye Energy Independence Project. A fuel oil sulfur content of 1.9 percent was used in calculating the projected actual SO_2 emissions for Phase I and Phase II in Tables 2-2 and 2-3. This represented the maximum fuel oil annual average sulfur content from 2000 through 2007, when data for the actual sulfur content was available.

Comment 6. **For the five years following the completion of construction and startup, describe in detail how you will determine SO_2 actual emissions for each affected emissions unit covered under this project to satisfy the reporting requirements of Rule 62-210.370, F.A.C. For this demonstration, address all of the allowable fuels (i.e., No. 6 fuel oil, on-specification fuel oil and tall oil) and include the following: use of any restricted fuel consumption; fuel monitoring; continuous monitoring; fuel deliveries (use of a bill-of-lading); fuel transfers (tall oil and/or on-specification used oil); fuel sampling (use of an as-fired drip sample: where, when and how); fuel-sampling analyses (in-house or out-sourced and response time for analysis); associated frequencies; and other methods to provide reasonable assurance that the project is not subject to PSD preconstruction review for SO_2 emissions.**

Response 6: The emissions of SO_2 will be determined for each individual fuel as follows:

- **Black Liquor Solids (BLS):**
  Emission Units firing fuel: No. 2 Recovery Boiler (EU 006) and No. 3 Recovery Boiler (EU 007).
  Fuel Monitoring: The amount of BLS fired in the Nos. 2 and 3 Recovery Boilers will be calculated by measuring the flow and density (percent solids) of the black liquor.
  Emissions Calculation: The SO_2 emissions will be determined by using the most current emission factor for BLS firing in NDCE recovery furnaces (currently 0.74 lb SO_2 per ton BLS from NCASI Technical Bulletin No. 884, Table 4.12, median value). This is the factor used to calculate the projected actual emissions.

- **No. 6 Fuel Oil / No. 2 Fuel Oil:**
  Emission Units firing fuel: No. 1 Power Boiler (EU 002), No. 1 Bark Boiler (EU 004), No. 2 Recovery Boiler (EU 006), No. 3 Recovery Boiler (EU 007), and No. 2 Bark Boiler (EU 019).
  Fuel Monitoring: The amount of fuel oil fired in the boilers is monitored by flow meters, and daily fuel consumption records are kept. The fuel oil sulfur content is documented in fuel receipts for every delivery to the facility.
  Emissions Calculation: The SO_2 emissions will be determined by using the annual average fuel oil sulfur content, as well as the current emission factor from AP-42, Table 1.3-1, which was used for the projected actual emissions [SO_2 = 157(S) pounds per thousand gallons]. It will be assumed that no SO_2 removal occurs in the wet scrubbers serving the bark boilers.

- **Natural Gas:**
  Emission Units firing fuel: No. 1 Power Boiler (EU 002) and No. 2 Power Boiler (EU 003).
  Fuel Monitoring: The amount of natural gas fired in the boilers is monitored by flow meters, and daily fuel consumption records are kept.
  Emissions Calculation: The SO_2 emissions will be determined by using the current emission factor from AP-42, Table 1.4-2 (0.6 pounds per million cubic feet).

- **Wood/Bark:**
  Emission Units firing fuel: No. 1 Bark Boiler (EU 004) and No. 2 Bark Boiler (EU 019).
  Fuel Monitoring: The amount of wood/bark fired in the boilers is determined by calculating the total heat input to the boilers from the steam production rates, and subtracting out the heat input due to fossil fuel combustion. The heating value for the wood is then used to determine the tons of wood fired.
  Emissions Calculation: The SO_2 emissions will be determined by using the most current emission factor for wood firing (currently 0.27 lb SO_2 per ton wood from NCASI Technical Bulletin No. 884, Table 9.6a, median value). This factor was used in determining the projected actual emissions. It is assumed that 40 percent of the SO_2 from wood/bark firing is removed in the Bark Boiler scrubbers.

- **Facility-Generated Tall Oil (blended with No. 6 fuel oil):**
  Emission Units firing fuel: No. 1 Power Boiler (EU 002), No. 1 Bark Boiler (EU 004), No. 2 Recovery Boiler (EU 006), No. 3 Recovery Boiler (EU 007), and No. 2 Bark Boiler (EU 019).
  Fuel Monitoring: The amount of tall oil blended with No. 6 fuel oil will be monitored by flow meters for continuous addition, and calculated by capacities of railcars and tank trucks during batch operations. Daily tall oil consumption records will be kept. The tall oil fuel oil sulfur content will be determined by calculating an annual average of monthly analyses of a representative sample.
  Emissions Calculation: The SO_2 emissions will be determined by a stoichiometric calculation using the sulfur content of the tall oil used, the tall oil burned, and the tall oil density. It will be assumed that no SO_2 removal occurs in the wet scrubbers serving the bark boilers.

- **Used Oil:**
  Emission Units firing fuel: No. 1 Power Boiler (EU 002), No. 1 Bark Boiler (EU 004), No. 2 Recovery Boiler (EU 006), No. 3 Recovery Boiler (EU 007), and No. 2 Bark Boiler (EU 019).
  Fuel Monitoring: The amount of purchased lubricating oil will be recorded, and will be assumed to all become used oil and combusted with No. 6 fuel oil.
  Emissions Calculation: The SO_2 emissions will be determined in the same way as with No. 6 fuel oil combustion. The sulfur content of the used oil will be conservatively assumed to be the same as that of the No. 6 fuel oil. It will be assumed that no SO_2 removal occurs in the wet scrubbers serving the bark boilers.

Comment 7. Are all of the affected emissions units receiving their fuel from a day tank(s) or directly from a bulk storage tank(s)?

Response 7: Buckeye utilizes an oil system that is common for all the boilers that can burn No. 6 oil [No. 1 Power Boiler (EU 002), No. 1 Bark Boiler (EU 004), No. 2 Recovery Boiler (EU 006), No. 3 Recovery Boiler (EU 007), No. 4 Recovery Boiler (EU 011), and No. 2 Bark Boiler (EU 019)]. There is a bulk storage tank (100,000 gallon capacity) on site where oil is stored as it is received from either truck or rail. When tall oil is being burned, it is mixed with No. 6 fuel oil in this bulk tank.

The tall oil is supplied to the No. 6 fuel oil bulk storage tank from tall oil storage tanks via tank truck, railcar, or direct piping.

The pumps on the No. 6 fuel oil storage tank circulate oil into the Powerhouse for additional heating and to supply the fossil fuel burners on the boilers that burn No. 6 fuel oil. After the heaters, the oil flows to each boiler where No. 6 oil is burned, as well as the No. 4 Lime Kiln (EU 024) fuel oil day tank. Oil is re-circulated through the burner supply piping at each boiler and is returned back to the No. 6 fuel oil storage tank. This system is designed to insure oil temperature is maintained at the appropriate temperature in the storage tank as well for firing at each boiler. There will be no changes to the No. 6 fuel oil storage or supply system as a result of the Foley Energy Independence Project.

The bark boilers can be fired on No. 6 fuel oil using their auxiliary fuel burners, but usually these burners are used for start-up, to supplement steam generation if other boilers are out-of-service, or during upset conditions. Generally fossil fuel usage on the bark boilers is kept to an absolute minimum, as steam generated from oil is much more expensive than steam generated from bark (biomass). The bark boilers generate steam predominantly from bark.

Bark is produced as a waste stream from the de-barking process of the logs received for the pulp process. Bark is also purchased as needed to have adequate quantities to fire the bark boilers. Wet bark is stored on the ground in a pile to be reclaimed for use in the boilers. The reclaimed bark first supplies a rotary dryer, where a portion of the flue gas from the No. 2 Bark Boiler is used to dry the bark. Bark is dried from a moisture content of approximately 50 percent to approximately 30-percent moisture content. After drying, the bark is conveyed to live bottom bins. There is one bin for each of the bark boilers. Bark is fed from the live bottom bins to fire each boiler. Currently the firing rates of the bark boilers vary inversely with the firing rate of the power boilers in order to maintain and control steam header pressure.

After the condensing turbine generator is installed, steam header pressure will be controlled by modulating the steam flow to the condensing turbine instead of varying the firing rate of the power and bark boilers. Therefore the bark boilers will be base loaded, which will allow them to operate at a higher average rate than if they have to vary to control header pressure as they currently do. There will not be an increase in the peak firing capability of the bark boilers as a result of the project. It is expected that the average steam generated from the bark boilers will increase.

As the steam generated from less expensive or free bio-mass fuels (bark and/or black liquor) increases due to the project changes, steam generated from fossil fuel usage in the power boilers will be decreased or at times eliminated. The project will not change the design or capability of the power boilers. The only change is the installation of the condensing turbine generator, which allows the steam header pressure control strategy to change.

Fifty-percent black liquor currently is supplied to a black liquor oxidation system for oxidation. Oxidation is required for liquor being fired in the direct contact evaporation recovery boilers (Nos. 2 and 3 Recovery Boilers) to allow operation with acceptable total reduced sulfur emissions. Currently, black liquor flows from the black liquor oxidation system to the cyclone evaporators on the No. 2 Recovery Boiler and to the precipitator mix tank on the No. 3 Recovery Boiler.

Black liquor recirculation pumps on the No. 2 Recovery Boiler cyclone evaporators recirculate liquor for evaporation, supply the precipitator mix tank, and supply the boiler salt cake mix tank. Liquor in the precipitator mix tank mixes with ash collected in the precipitator with the black liquor and flows by gravity back to the cyclone evaporators. Black liquor from the salt cake mix tank circulates to mix with ash collected in the generating section of the boiler and also supplies the black liquor burner pumps on the boiler. When the Foley Energy Independence Project is implemented, concentrated

black liquor from liquor storage tanks will be fed directly to the salt cake mix tank. The circulation system and burner pumps on the salt cake mix tank will not be changed and the system will have the same operating capacity as the current system.

Oxidized black liquor, as stated above, is currently supplied to the precipitator mix tank on the No. 3 Recovery Boiler. Liquor in the precipitator mix tank mixes ash collected in the precipitator with the black liquor and is pumped to a sluice hopper under the generating section of the boiler. Ash collected in the generating section of the boiler mixes with the liquor and flows by gravity to the cascade evaporator. Concentrated black liquor from the cascade evaporator then flows to a salt cake mix tank which supplies the black liquor burner pumps for the boiler.

When the Foley Energy Independence Project is implemented, concentrated black liquor will be fed directly from liquor storage tanks to the salt cake mix tank. The burner pumps on the salt cake mix tank will not be changed and the system will have the same capability and the same operating function as current.

Currently the No. 2 Recovery Boiler and No. 3 Recovery Boiler, as described above, are being supplied with 50-percent oxidized black liquor. Concentrating the black liquor to the firing concentration (approximately 70 percent solids) is currently coupled to boiler operation, i.e. liquor can only be concentrated with the boiler in operation and concentrated liquor is only needed with the boiler in operation.

When the Foley Energy Independence Project is implemented, the concentration of black liquor to the firing concentration will no longer be coupled to recovery boiler operation. Black liquor concentration will occur in the concentrators, which will be coupled with evaporator operation. Therefore, concentrated black liquor storage is required to be able to operate the boilers when concentrator/evaporators systems are down for maintenance.

The No. 4 Recovery Boiler currently is a non-direct contact design boiler where concentration of the firing liquor is accomplished in a concentrator/evaporator system (No. 4 concentrator/black liquor evaporator). There currently is a concentrated black liquor storage tank used to store 65-70 percent black liquor from the No. 4 Concentrator and supply the No. 4 Recovery Boiler. When the Nos. 2 and 3 Recovery Boilers are converted to non-direct contact operation, they will also need to be supplied from a concentrated black liquor storage tank. The existing tank is not adequately sized to support operation of all three recovery boilers if a concentrator/evaporator system is down for maintenance. Therefore an additional concentrated black liquor storage tank will be installed. The new tank and existing tank will be designed such that the pumps and piping will allow any or all of the recovery boilers to be supplied from either tank, and concentrated black liquor can be transferred between tanks.

Comment 8. **How much steam is needed to drive the new steam generator and at what pressure and temperature?**

Response 8: The required steam to drive the new steam generator is 153,000 lb/hr. The required pressure and temperature are 600 psi and 700 degrees Fahrenheit.

Comment 9. **Your response to question No. 22 in the January 10th RAI was inadequate. As previously requested, please provide the following reference documents, or at least the excerpts from the documents that were used and referenced:**

- **NCASI Technical Bulletin No. 94**
- **NCASI Technical Bulletin No. 416**

- **NCASI Technical Bulletin No. 701**
- **NCASI Special Report #93-03**
- **NCASI Environmental Resource Handbook – Chemical Recovery Process (Tables A-1 & A-7)**
- **NCASI Environmental Resources Handbook 3-02 (Tables A-23 & A-29)**

If Technical Bulletin No. 650 has been updated since June 1993, please provide.

Response 9: Emission factors from these documents were not used in calculating the baseline actual emissions in the application. These emission factors were referenced in the facility Annual Operating Reports (AORs), which have been submitted to FDEP each year. These emission factors were only referenced, in order to show the difference between the original AOR factors and the factors used in the revised emission factor tables. The baseline emissions were based on the revised emission factors. Nevertheless, the excerpts from these documents have been included as Attachment D of this response.

It is noted that the emission factors in the NCASI Environmental Resource Handbook may be different than the factors used in Tables A-1, A-7, A-13, A-18, A-23, A-29, and A-35, as this document may have been revised over the years with more recent and more accurate data. The revised emission factors in Tables A-2, A-8, A-14, A-24, A-30, and A-36 are the most up to date emission factors available, and the reference materials for these factors have been provided in previous submissions to FDEP.

Thank you for your consideration of this information. If you have any questions, please do not hesitate to call me at (352) 336-5600.

Sincerely,

GOLDER ASSOCIATES INC.

David A. Buff

David A. Buff, P.E., Q.E.P.
Principal Engineer

DB/sl

Enclosures

cc: D. Weeden – Buckeye

Y:\Projects\2007\07387656 Buckeye\Correspondence\RAI #2\R052008_656.docx

FACILITY INFORMATION

Professional Engineer Certification

1. Professional Engineer Name: **David A. Buff**
   Registration Number: **19011**
2. Professional Engineer Mailing Address...
   Organization/Firm: **Golder Associates Inc.****
   Street Address: **6241 NW 23rd Street, Suite 500**
   City: **Gainesville** State: **FL** Zip Code: **32653**
3. Professional Engineer Telephone Numbers...
   Telephone: **(352) 336-5600** ext.**545** Fax: **(352) 336-6603**
4. Professional Engineer Email Address: **dbuff@golder.com**
5. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

(3) If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.

(4) If the purpose of this application is to obtain an air construction permit (check here ☒, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here ☐, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

David A. Buff
Signature

5/21/08
Date

(seal)

* Attach any exception to certification statement.

** Board of Professional Engineers Certificate of Authorization #00001670

ATTACHMENT A

PROCESS FLOW DIAGRAMS

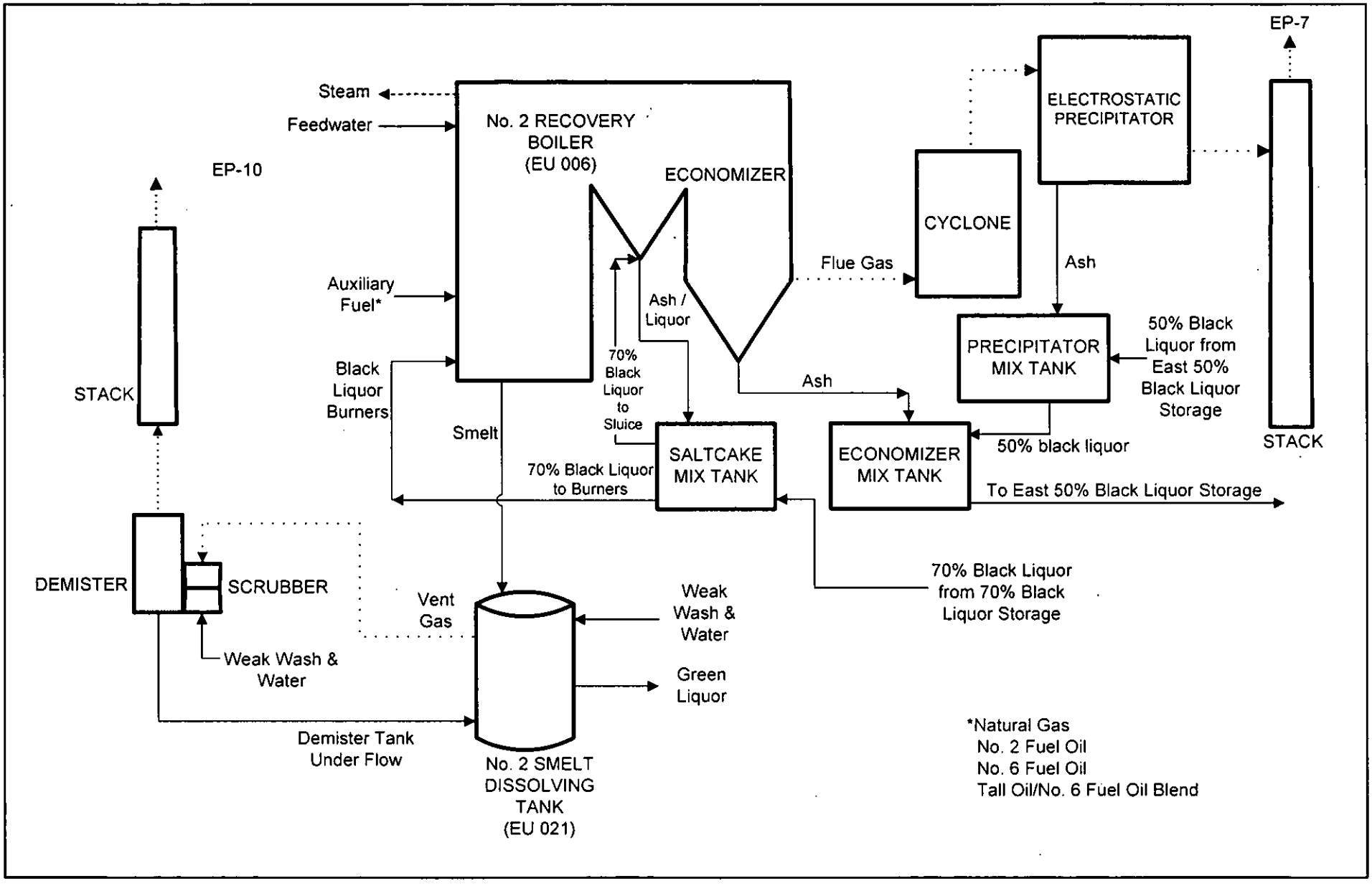

Figure 2-9
No. 2 Recovery Boiler: After Low Odor Conversion Flow Diagram
Buckeye Florida, L.P.

EIP\FIG 2-9.VSD

Process Flow Legend
Solid/Liquid
Gas
Steam

Golder Associates

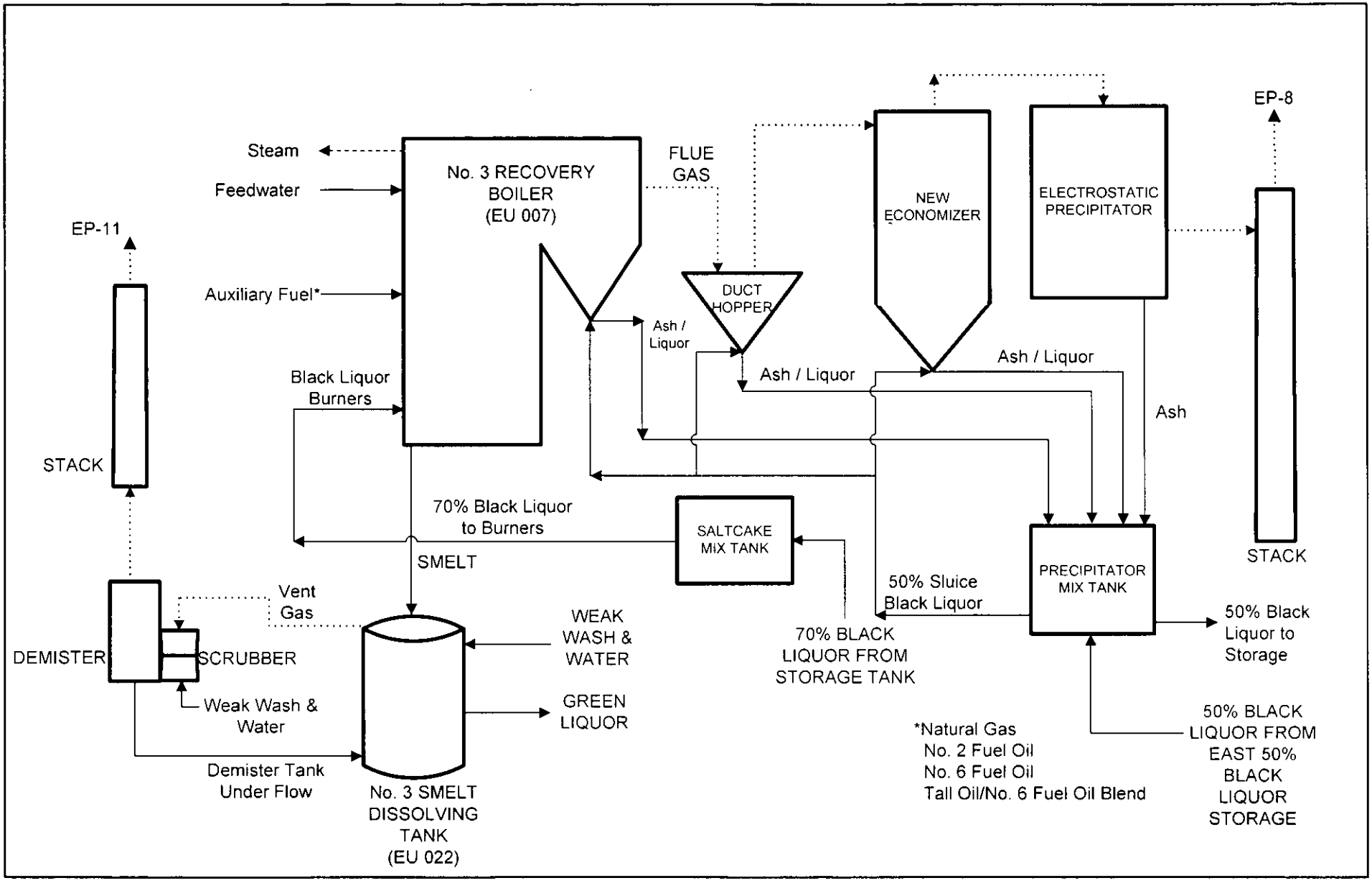

Figure 2-10
No. 3 Recovery Boiler: After Low Odor Conversion Flow Diagram
Buckeye Florida, L.P.

EIP\FIG 2-10.VSD

Process Flow Legend
Solid/Liquid
Gas
Steam

Golder Associates

ATTACHMENT B

AIR CONSTRUCTION PERMITS FOR CONTEMPORANEOUS PROJECTS

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

David B. Struhs
Secretary

October 9, 2001

NOTICE OF PERMIT

CERTIFIED-RETURN RECEIPT

Mr. Howard Drew, V. P., Wood Cellulose Manufacturing
Buckeye Florida, Limited Partnership
One Buckeye Drive
Perry, Florida 32348-7702

Dear Mr. Drew:

Taylor County - AP
Buckeye Florida, Limited Partnership
MACT I Compliance:
No. 1 Bark Boiler,
No. 1 Power Boiler
No. 2 Purification Plant
Pulping System – MACT I

Enclosed is Permit Numbers 1230001-011-AC and 1230001-012-AC to construct the subject air pollution emissions unit(s), issued pursuant to Section 403.087, Florida Statutes (FS).

Any party to this order has the right to seek judicial review of it under section 120.68 of the Florida Statutes, by filing a notice of appeal under rule 9.110 of the Florida rules of Appellate Procedure with the clerk of the Department of Environmental Protection in the Office of General Counsel, Mail Station 35, 3900 Commonwealth boulevard, Tallahassee, Florida, 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice must be filed within thirty days after this order is filed with the clerk of the Department.

Executed in Jacksonville, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

OCT 12 2001

Christopher L. Kirts, P. E.
District Air Program Administrator

CLK:RFS

cc: Carla Ferguson, Buckeye Florida, Limited Partnership
David A. Buff, P.E., Golder Associates, Inc.

FILING AND ACKNOWLEDGEMENT
FILED, on this date pursuant to §120.52 Florida Statutes, with the Department Clerk, receipt of which is hereby
Dorothy Bonefield 10/11/01

"More Protection, Less Process"

Printed on recycled paper.

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

David B. Struhs
Secretary

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive
Perry, Florida 32347

I.D. Number:	1230001
Permit/Cert Number:	1230001-011-AC 1230001-012-AC
Date of Issue:	October 9, 2001
Expiration Date:	October 9, 2003
County:	Taylor
Latitude/Longitude:	30° 03' 59" N; 83° 33' 12" W
UTM:	E-(17) 256.7; N-3328.7
Project:	MACT I Compliance: No. 1 Bark Boiler, No. 1 Power Boiler No. 2 Purification Plant Pulping System – MACT I

This permit is issued under the provisions of Chapter(s) 403, Florida Statutes, and Florida Administrative Code Rule(s) 62-210, 62-212, 62-296, 62-297 and 62-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the department and made a part hereof and specifically described as follows:

For the installation and implementation of equipment necessary for compliance with the kraft pulping and bleaching systems standards of 40 CFR Part 63, Subpart S (MACTI), the emission units are identified below:

Emission Unit 002: No. 1 Power Boiler

Emission Unit 004: No. 1 Bark Boiler

Emission Unit 041: No. 2 Purification Plant

Emission Unit 046: Pulping System MACT I

The Pulping System – MACT I includes those sources regulated under MACT I: Nos. 1 and 2 Batch Digester systems, the Turpentine Recovery system (includes the turpentine Condenser, Decanter, Weir Box, and Underflow Tank), Multiple Effect Evaporator systems (Nos. 1-4), and the Pulping Process Condensate Collection System.

Project Description:

Buckeye Florida, Limited Partnership – Foley Mill, was granted a Pollution Control Project (PCP) Exclusion for this project pursuant to the requirements of Rule 62-212.400(2)(a)2.b, F.A.C.

Noncondensible gases (NCGs) from the existing turpentine decanter, the turpentine underflow tank, and the digester accumulator lines will be collected and tied into the existing Low Volume High Concentration (LVHC) gas collection system, then routed for combustion to the No. 1 Bark Boiler (primary device) or the No. 1 Power Boiler (secondary/backup device for MACT).

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number: 1230001
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Expiration Date: October 9, 2003
County: Taylor

The estimated increase in TRS and SO2 emissions as a result of the combustion of the NCGs from these sources in the No. 1 Bark Boiler are 9.3 E –04 TPY and 0.3 TPY, respectively.

This project is part of the MACT compliance plan for the Foley plant and will result in a net emissions decrease of 49.9 TPY of TRS and 5.7 TPY of HAPs. For the No. 1 Power Boiler, the estimated increase in SO2, TRS, HAPs, and SAM emissions as a result of NCG burning in the No. 1 Power Boiler (while burning natural gas) from all MACT required sources, is 124.1 TPY, 0.13 TPY, 0.16TPY and 7.6 TPY, respectively.[1] Buckeye has elected to either (1) burn only natural gas or (2) burn limited amounts of fuel oil with pre-scrubbing from the existing backup scrubber while LVHC NCGs are burned in the No. 1 Power Boiler. As a result, this project will not result in an increase in the allowable emissions for SO2 at this emissions unit. The No. 1 Power Boiler will be used as the backup control device to the No. 1 Bark Boiler for a period of time not to exceed 20 days out of a calendar year (i.e. 480 hr/yr).

The equipment at each bleaching stage of the No. 2 Purification Plant, where chlorinated compounds are introduced, will be enclosed and vented into a closed-vent system and routed to the wet scrubber. A continuous monitoring system (CMS) will be installed to measure parameters established by the 40 CFR Part 63, Subpart S regulation.

[1] Summary of the net emissions changes based on LVHC NCG Combustion in the No. 1 Power Boiler (as a secondary control device):

		Pollutants Emission Rate (TPY)							
		SO2	NOx	CO	PM/P M10	TRS	VOC	SAM	HAPs
Total Proposed Modifications	▪ No. 1 Power Boiler as backup/secondary device and firing natural gas (MODE 1)*	124.1	---	---	---	0.13	---	7.6	0.16
	▪ No. 1 Power Boiler as backup/secondary device and firing fuel oil w/ existing TRS scrubber (at No. 1 Bark Boiler) as preliminary control device (MODE 2)*	62.1**	---	---	---	0.07**	---	3.8**	0.16
Existing Emissions	▪ No. 1 Power Boiler as backup/secondary device for LVHC NCG gases	0	---	---	---	0	---	0	0
	▪ Backup TRS* Scrubber for LVHC NCG gases at the No. 1 Bark Boiler	---	---	---	---	50	---	0	5.9
Total of Existing Emissions		0	---	---	---	50	---	0	5.9
TOTAL NET CHANGE		124.1**	---	---	---	-49.9	---	7.6**	-5.7

* The No. 1 Power Boiler is the backup combustion device to comply with MACT I requirements for control of LVHC gases. It will be operated in either of two modes. Mode 1: The No. 1 Power Boiler is the backup TRS combustion device while burning natural gas and LVHC. Mode 2: LVHC NCG gases will be routed to the existing TRS scrubber (previously used at the No. 1 Bark Boiler) as a preliminary TRS control, followed by combustion in the No. 1 Power Boiler during time periods only when fuel oil and LVHC gases are burned in this boiler.

** May be less if TRS Removal in existing TRS scrubber is greater than the estimated 50%.

* For existing emissions at the No. 1 Bark Boiler, the TRS Scrubber is the TRS Control backup control device

** Above Significant Threshold. A Pollution Control Project (PCP) Exclusion was granted pursuant to 62-212.400(2)(a)2.b.

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number:	1230001
Permit/Cert Number:	1230001-011-AC
Date of Issue:	October 9, 2001
Expiration Date:	October 9, 2003
County:	Taylor

Project Description Continued:

Located: Route 17, Perry, Taylor County, Florida.

In accordance with:

Construction permit application for the No. 1 Bark Boiler received April 14, 1999
Additional Information Received June 9, 1999
Intent to Issue and Draft permit dated August 20, 1999
Comments from Buckeye Received September 16, 1999
Comments from Applicant received March 23, 2001
Comments from Applicant received April 18, 2001
Comments from Applicant received April 19, 2001
Comments from Applicant received August 24, 2001
Comments from Applicant received September 13, 2001

Construction permit application for the No. 1 Power Boiler received July 10, 2000
Additional Information Received November 13, 2000
Additional Information Received February 12, 2001
Comments from Applicant received April 18, 2001
Comments from Applicant received April 19, 2001
Additional Information Received June 4, 2001
Comments from Applicant received June 20, 2001
Comments from Applicant received August 24, 2001
Comments from Applicant received September 13, 2001

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number:	1230001
Permit/Cert Number:	1230001-011-AC
Date of Issue:	October 9, 2001
Expiration Date:	October 9, 2003
County:	Taylor

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of the conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys not title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permitted to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

   a. Have access to and copy any record that must be kept under the conditions of the permit;

   b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

   c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number:	1230001
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Expiration Date:	October 9, 2003
County:	Taylor

GENERAL CONDITIONS:

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

   a. A description of and cause of non-compliance; and

   b. The period of non-compliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 62-4.120 and 62-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

( ) Determination of Best Available Control Technology (BACT)
( ) Determination of Prevention of Significant Deterioration (PSD)
( ) Compliance with New Source Performance Standards (NSPS)
(X) Compliance with National Emission Standards for Hazardous Air Pollutants/ Maximum Available Control Technology (MACT)

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
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I.D. Number:	1230001
Permit/Cert Number:	1230001-011-AC
Date of Issue:	October 9, 2001
Expiration Date:	October 9, 2003
County:	Taylor

GENERAL CONDITIONS:

14. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurement;
- the dates analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number:	1230001
Permit/Cert Number:	1230001-011-AC
Date of Issue:	October 9, 2001
Expiration Date:	October 9, 2003
County:	Taylor

SPECIFIC CONDITIONS:

1. Total HAP emissions from the following equipment systems shall be controlled as specified in Specific Condition No. 2:

   - Batch digesters
   - The turpentine recovery system (condensers, decanters)
   - The multiple effect evaporators
   - Any other equipment serving the same function as those previously listed

   [40 CFR 63.443(a)]

   Note: Non-decanting turpentine storage tanks containing saleable product are not considered part of the turpentine recovery process. [EPA MACT I Rule Interpretation: Q&A's For The Pulp and Paper NESHAP, EPA Document, 9/22/99, Florida DEP Memorandum: Summary of Responses to MACT I Issues... dated August 29, 2000]

2. Each equipment system listed in Specific Condition No. 1 shall be enclosed and vented into a closed-vent system and routed to the No. 1 Bark Boiler or the No. 1 Power Boiler for control of total HAP emissions. The enclosures and closed-vent system shall meet the requirements specified in Specific Condition No. 14. The HAP emission stream shall be introduced with the primary fuel or into the flame zone; or controlled in a boiler with a heat input capacity greater than or equal to 150 million British thermal Units per hour by introducing the HAP emission stream with the combustion air.
   [40 CFR 63.443(c), 40 CFR 63.443(d)(4)(i) and (ii)].

3. Periods of excess emissions reported under Specific Condition No. 13 shall not be a violation of Specific Condition No. 2 provided that the time of excess emissions (excluding periods of startup, shutdown, or malfunction) divided by the total process operating time in a semi-annual reporting period does not exceed 4% for the No. 1 Bark Boiler and the No. 1 Power Boiler. [40 CFR 63.443(e)]

   Excess emissions due to startup, shutdown or malfunction are allowed for up to eight (8) hours in any 24 hour period unless otherwise requested and approved, provided effort is made to minimize emissions and duration in accordance with Rule 62-210.700 F.A.C.

The following conditions apply to Emission Units 002, The No. 1 Power Boiler:

Total Reduced Sulfur (TRS) Requirements (when NCGs are routed to the No. 1 Power Boiler for combustion and the TRS backup scrubber is not in operation):

4a. Emission Limits and Standards. When NCG gases are collected and routed to this Emissions Unit, and the unit is firing natural gas, TRS emissions shall not exceed 5 ppmvd @ 10% O2, as a 12 hour average; 2.28 lbs/hr and 0.55 TPY. TRS Emissions shall be incinerated for a minimum of 0.5 second and at a minimum of 1200°F.
[Rule 62-296.404(3)(f)1., F.A.C.]

4.b. TRS Emissions. It is assumed that compliance with the TRS emissions limit stated in Specific Condition 4.a. is achieved by maintaining the minimum temperature of 1200°F and the 0.5 second residence time.
[Rule 62-404(3)(a)1., 40 CFR 60.283(a)(1)(iii)]

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

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Date of Issue: October 9, 2001
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County: Taylor

SPECIFIC CONDITIONS:

5. The HAP emission stream shall be routed to the No. 1 Power Boiler for destruction for a period not to exceed 20 calendar days per year, i.e. 480 hours per year unless otherwise approved by the Department.

The following conditions apply to Emission Unit 041, No. 2 Purification Plant:

6. Capacity. The maximum allowed operation rate is listed below:

RATE	MATERIAL
1681 TPD[1]	Bone-dry Unbleached Pulp Feed

[1] Based on a nominal operation rate of 700 TPD for the No. 1 Purification Plant and 981 TPD for the No. 2 Purification Plant. (Ton =2000 pounds).

{Permitting note: The capacity limitations have been placed in this permit to identify the capacity of each emissions unit for purposes of confirming that emissions testing is conducted within 90-100 percent of the emissions unit's rated capacity (or to limit future operation to 110 percent of the test load), to establish appropriate limits and to aid in determining future rule applicability.}

[Construction permit Number 1230001-013-AC; Final Title V Permit Number 123001-007-AV]

7. The equipment at each bleaching stage of the No. 2 Purification Plant, where chlorinated compounds are introduced, shall be enclosed and vented into a closed-vent system and routed to the gas scrubber that meets the requirements specified in Specific Condition No. 8. The enclosures and closed-vent system shall meet the requirements specified in Specific Condition No. 14. If process modifications are used to achieve compliance with the emissions limit specified in Specific Condition No. 8, enclosures and closed-vent systems are not required, unless appropriate. [40 CFR 63.445(b)]

8. The gas scrubber listed in Specific Condition No. 7 shall achieve a treatment device outlet concentration of 10 parts per million or less by volume of total chlorinated HAP measured as chlorine. [40 CFR 63.445(c)(2)].

9. The permittee shall comply with the MACT requirements for chloroform emissions at this emissions unit by eliminating the use of chlorine and sodium hypochlorite used for bleaching in the No. 2 purification plant. [40 CFR 63.445(d)(2)].

The following conditions are common to Emission Units Nos. 002, 004, 041, and 046:

10. The ID Number and Project Name for this source shall be used on all correspondences.

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SPECIFIC CONDITIONS:

11. The following specific conditions of the below referenced permits shall be superceded with the issuance of this permit:

Emission Unit	Permit Number	Specific Condition Number(s)
No. 2 Purification Plant	1230001-013-AC	13
	1230001-005-AV	N.4., N.5., N.6.

12. The permittee shall comply with the applicable requirements of 40 CFR Part 63, Subpart S no later than April 17, 2002 as extended pursuant to 40 CFR Part 63, Subpart A [1]. [40 CFR 63.440(d)].

[1] Letter from Christopher Kirts, FDEP to John Crowe, Buckeye dated January 4, 2000.

13. The permittee shall comply with the requirements of 40 CFR Part 63, Subpart A- General Provisions as indicated in Table 1 of Subpart S.
[40 CFR 63.440(g)].

Standards for enclosures and closed-vent systems:

14. Each enclosure and closed-vent system specified in Specific Conditions Nos. 2 and 7 for capturing and transporting vent streams that contain HAP shall meet the following requirements.

(a) Each enclosure shall maintain negative pressure at each enclosure or hood opening as demonstrated by the procedures specified in Specific Condition No. 25. Each enclosure or hood opening closed during the initial performance test specified in Specific Condition No. 22 shall be maintained in the same closed and sealed position as during the performance test at all times except when necessary to use the opening for sampling, inspection, maintenance, or repairs.

(b) Each component of the closed-vent system used to comply with Specific Conditions Nos. 2 and 7 that is operated at positive pressure and located prior to a control device shall be designed for and operated with no detectable leaks as indicated by an instrument reading of less than 500 parts per million by volume above background, as measured by the procedures specified in Specific Condition No. 24.

(c) Each bypass line in the closed-vent system that could divert vent streams containing HAP to the atmosphere without meeting the emission limitations in §§63.443 and §§63.445 shall comply with one of the following requirements:

(1) On each bypass line, the permittee shall install, calibrate, maintain, and operate according to manufacturer's specifications a flow indicator that provides a record of the presence of gas stream flow in the bypass line at least once every 15 minutes. The continuous monitor will measure the valve position of the vent valve as a flow indicator. All valve positions other than closed will indicate flow in the bypass line; and

(2) For bypass line valves that are not computer controlled, the permittee shall maintain the bypass line valve in the closed position with a chained and locked closure mechanism in such a way that the valve or closure mechanism cannot be opened without recording and reporting the valve opening.

Note: Buckeye plans on demonstrating compliance with Specific Condition No.14(c)(1) by monitoring computer (DCS) controlled automatic valves with a continuous indication of any venting and the capability to record venting periods at least once every 15 minutes on each bypass line. The bypass lines are (2) two ten-inch vent collection lines located in the pulping and power operating departments.
[40 CFR 63.450]

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SPECIFIC CONDITIONS:

Monitoring Requirements

15. The permittee shall install, calibrate, certify, operate, and maintain according to the manufacturer's specifications, a continuous monitoring system (CMS) as specified in Specific Condition No. 16.a. The CMS shall include a continuous recorder. [40 CFR 63.453(a)].

16.a. A CMS shall be operated to measure the following parameters for the gas scrubber used to comply with the bleaching system requirement in Specific Condition No. 8:
(1) The pH or the oxidation/reduction potential of the gas scrubber effluent;
(2) The gas scrubber liquid influent flow rate; and
(3) The on/off operation of the scrubber fan. [1]
[40 CFR 63.453(c)]

[1] An alternative to monitoring the gas inlet flow rate. Buckeye also proposes to 1) provide the manufacturer scrubber fan curve date in the performance test plan and in the CMS Quality Control Program; 2) conduct outlet gas scrubber flow measurement during the initial performance test and test at maximum gas flow conditions; 3) notify FDEP-NED prior to making any changes that will affect the maximum gas flow rate (i.e., motor replacement, fan replacement); and 4) conduct performance testing after making any future changes which could increase the maximum inlet flow rate.
[EPA MACT I Rule Interpretation: Q&A's For The Pulp and Paper NESHAP, EPA Document, 9/22/99, Florida DEP Memorandum: Summary of Responses to MACT I Issues... dated August 29, 2000, Buckeye Letter dated 4/17/01]

16.b. The permittee may request to use an alternative monitoring method for those stated in Specific Condition No.16.a, by submitting an application to the Administrator (USEPA) as described in 40 CFR 62.8(f)(4)(ii). However, until the Administrator (USEPA) has granted such approval, the permittee remains subject to the requirements of Specific Condition No.16.a.
[40 CFR 63.8(f)]

17. Each enclosure and closed-vent system used to comply with Specific Condition No.14 shall comply with the following requirements:

(1) For each enclosure opening, a visual inspection of the closure mechanism specified in Specific Condition No. 14 (a) shall be performed at least once every 30 days to ensure the opening is maintained in the closed position and sealed.

(2) Each closed-vent system shall be visually inspected at least once every 30 days and at other times as requested by the Administrator. The visual inspection shall include inspection of ductwork, piping, enclosures, and connections to covers for visible evidence of defects.

(3) For positive pressure closed-vent systems or portions of closed-vent systems, demonstrate no detectable leaks as specified in Specific Condition No.14.(b) measured initially and annually by the procedures in Specific Condition No. 24.

(4) Demonstrate initially and annually that each enclosure opening is maintained at negative pressure as specified in Specific Condition No. 25.

(5) The valve or closure mechanism specified in Specific Condition No. 14.(c)(2) shall be inspected at least once every 30 days to ensure that the valve is maintained in the closed position and the emission point gas stream is not diverted through the bypass line.

(6) If an inspection required by Specific Conditions Nos. 17.(1) through 17.(5) identifies visible defects in ductwork, piping, enclosures or connections to covers required in Specific Condition No.14, or if an instrument reading of 500 parts per million by volume or greater above background is measured, or if enclosure openings are not maintained at negative pressure, then the following corrective actions shall be taken as soon as practicable.

(i) A first effort to repair or correct the closed-vent system shall be made as soon as practicable but no later than 5 calendar days after the problem is identified.

(ii) The repair or corrective action shall be completed no later than 15 calendar days after the problem is identified. Delay of repair or corrective action is allowed if the repair or corrective action is technically infeasible without a process unit shutdown or if the owner or operator determines that the emissions resulting from immediate repair would be greater than the emissions likely to result from delay of repair. Repair of such equipment shall be completed by the end of the next process unit shutdown.

[40 CFR 63.453(k)]

18. For each control device, technique or an alternative parameter other than those specified in Specific Condition Nos. 2, 16.a., and 17, the permittee shall install a CMS and establish appropriate operating parameters to be monitored that demonstrate, to the EPA Administrator's satisfaction, continuous compliance with the applicable control requirements.
[40 CFR 63.453(m)]

19. The permittee shall use the following procedures to establish or reestablish the value for each operating parameter required to be monitored under Specific Condition Nos. 16.a., and 18 or to establish appropriate parameters for Specific Condition No. 18.
(1) During the initial performance test required in Specific Condition No. 22 or any subsequent performance test, continuously record the operating parameter;
(2) Determinations shall be based on the control performance and parameter data monitored during the performance test, supplemented if necessary by engineering assessments and the manufacturer's recommendations;
(3) The owner or operator shall provide for the EPA Administrator's approval the rationale for selecting the monitoring parameters necessary to comply with Condition No. 18, and;
(4) Provide for the Division of Air Resource Management (DARM) or the EPA Administrator's (as applicable) approval the rationale for the selected operating parameter value, and monitoring frequency, and averaging time. Include all data and calculations used to develop the value and a description of why the value, monitoring frequency, and averaging time demonstrate continuous compliance with the applicable emission standard.
[40 CFR 63.453(n)]

20. The permittee shall operate the control device in a manner consistent with the minimum or maximum (as appropriate) operating parameter value or procedure required to be monitored and established under Specific Conditions Nos. 15, 16.a., 17 through 19. Except as provided in Specific Condition No. 3, operation of the control device below minimum operating parameter values or above maximum operating parameter values established under this subpart or failure to perform procedures required by this subpart shall constitute a violation of the applicable emission standard of this subpart and be reported as a period of excess emissions.
[40 CFR 63.453(o)].

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SPECIFIC CONDITIONS:

Recordkeeping Requirements

21. For each applicable enclosure opening, closed-vent system, and closed collection system, the permittee shall prepare and maintain a site-specific inspection plan including a drawing or schematic of the components of applicable affected equipment and shall record the following information for each inspection:
    (1) Date of inspection;
    (2) The equipment type and identification;
    (3) Results of negative pressure tests for enclosures;
    (4) Results of leak detection tests;
    (5) The nature of the defect or leak and the method of detection (i.e., visual inspection or instrument detection);
    (6) The date the defect or leak was detected and the date of each attempt to repair the defect or leak;
    (7) Repair methods applied in each attempt to repair the defect or leak;
    (8) The reason for the delay if the defect or leak is not repaired within 15 days after discovery;
    (9) The expected date of successful repair of the defect or leak if the repair is not completed within 15 days;
    (10) The date of successful repair of the defect or leak;
    (11) The position and duration of opening of bypass line valves and the condition of any valve seals; and
    (12) The duration of the use of bypass valves on computer controlled valves.
    [40 CFR 63.454(b)]

Test methods and procedures

22. Initial performance test. An initial performance test is required for all emission sources subject to the limitations in §§63.443, and 63.445, except those controlled by a combustion device that is designed and operated as specified in Specific Condition No. 2. [40 CFR 63.457(a)]

23. Vent sampling port locations and gas stream properties. For purposes of selecting vent sampling port locations and determining vent gas stream properties, required in §§63.443 and 63.445, the permittee shall comply with the applicable procedures specified in §63.457(b). [40 CFR 63.457(b)]

24. Detectable leak procedures. To measure detectable leaks for closed-vent systems as required in Specific Condition No.14.(b), the permittee shall comply with the requirements of §63.457(d).
    [40 CFR 63.457(d)]

25. Negative pressure procedures. To demonstrate negative pressure as required in Specific Condition No. 14(a) at process equipment enclosure openings, the permittee shall comply with the requirements of §63.457(e).
    [40 CFR 63.457(e)]

26. *HAP concentration measurements.* For purposes of complying with the requirements in §63.443, the permittee shall measure the total HAP concentration as one of the following:
    (1) As the sum of all individual HAPs; or
    (2) As methanol.
    [40 CFR 63.457(f)]

27. Bleaching HAP concentration measurement. For purposes of complying with the bleaching system requirements in §63.445, the permittee shall measure the total HAP concentration as the sum of all individual chlorinated HAP's or as chlorine. [40 CFR 63.457(h)]

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28. Vent gas stream calculations. To demonstrate compliance with the mass emission rate, mass emission rate per megagram of ODP, and percent reduction requirements for vent gas streams specified in §63.443 and 63.445, the permittee shall comply with the requirements of §63.457(i). [40 CFR 63.457(i)]

Terms/Definitions:

29. The term "immediately" as used in General Condition Number 8 of this permit shall mean "within 24 hours or the next working day". [Applicant Request dated 4/18/01]

30. The term "work site" as used in General Condition Number 12 of this permit shall mean "facility". [Applicant Request dated 4/18/01]

31. The term "monitoring information" as used in General Condition Number 14.b. shall include electronic data. [Applicant Request dated 4/18/01]

Submittals:

32. All reports, tests, notifications or other submittals required by this permit shall be submitted to the:

Department of Environmental Protection
Northeast District – Air Program
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256
Telephone: 904/448-4310
Fax: 904/448-4366

33. The permittee shall submit an application for a Title V permit revision, or Title V permit renewal, as applicable, no later than November 30, 2002 [1] for the Low Volume High Concentration system, the pulping condensates, and the bleaching systems; and no later than November 30, 2006 [1] for the High Volume Low Concentration system. [Final Title V Permit No. 1230001-007-AV issued November 8, 2000]

[1] Note: If 40 CFR Part 63 is modified to allow for applicable time extension requests, the applicant may apply for an extension to the respective deadlines.

Executed in Jacksonville, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

FILING AND ACKNOWLEDGEMENT
FILED, on this date, pursuant to §120.52 Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.
Clerk 10/11/01 Date

Christopher L. Kirts, P.E.
District Air Program Administrator

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B-200
Jacksonville, Florida 32256-7590

Colleen Castille
Secretary

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive
Perry, Florida 32347

I.D. Number:	1230001
Permit/Cert Number:	1230001-018-AC
Date of Issue:	February 16, 2005
Expiration Date:	February 16, 2006
County:	Taylor
Latitude/Longitude:	30° 03' 59" N; 83° 33' 12" W
UTM:	E-(17) 256.7; N-3328.7
Project:	No. 1 Power Boiler

This permit is issued under the provisions of Chapter(s) 403, Florida Statutes, and Florida Administrative Code Rule(s) 62-210, 62-212, 62-296, 62-297 and 62-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the department and made a part hereof and specifically described as follows:

PROJECT #018

Authorizes the use of the No. 1 Power Boiler (Emissions Unit 002) as the backup control device for NCG and TRS destruction for up to 960 hours per year. This is an increase from 480 hours per year authorized under Construction Permit No. 1230001-011-AC.

Noncondensible gases (NCGs) from the existing turpentine decanter, the turpentine underflow tank, and the digester accumulator lines are collected and tied into the existing Low Volume High Concentration (LVHC) gas collection system, then routed to the No. 1 Bark Boiler (primary device) or the pre-scrubber followed by the No. 1 Power Boiler (secondary/backup device for MACT) for combustion. TRS removal by the pre-scrubber has been confirmed by inlet and outlet testing to be least 50%.

Because the pre-scrubber will be operated as a permanent part of the backup LVHC control system, the increase in the allowable hours of NCG burning in the No. 1 Power Boiler will not result in an increase in SO_2 or SAM emissions. Estimates of HAP emissions have increase slightly over the values presented in the July 2000 MACT I permit application due to updated NCASI factors. TRS annual emissions have increased due to the increase in the allowable hours of NCG burning. The net emissions changes based on the revised LVHC NCG combustion conditions for the No. 1 Power Boiler are summarized in the table below.

In addition, in this permit, the Department corrects the rule citation in Specific Condition 4.b of Construction Permit No. 1230001-011-AC, as in incorrectly cites 40 CFR 60.283(a)(1)(iii) as the basis of the condition. None of the sources venting to the LVHC system (i.e., batch digester system, multiple effect evaporator system, and the turpentine system) are subject to 40 CFR 60 Subpart BB.

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Buckeye is required to continuously monitor and record the Total Reduced Sulfur (TRS) emissions incineration temperature at the No. 1 Bark Boiler. This requirement is based on an agreement between Mr. C.S. Aiken, Plant Manager of The Procter & Gamble Cellulose Company (Buckeye's predecessor), and the Bureau of Air Regulation. It was summarized in the Construction Permit Amendment letter for No. 1 Bark Boiler, dated May 17, 1990.

Because the No. 1 Power Boiler is the backup control device to the No. 1 Bark Boiler for TRS emissions, the TRS requirements are now consistent between the two boilers.

This permit also reduces the permitted TRS emissions at the No. 1 Bark Boiler based on the amended construction permit application pages received October 5, 2004.

Summary of the net emissions changes based on the revised LVHC NCG combustion conditions for the No. 1 Power Boiler (as a secondary control device):

		Pollutants Emission Rate (TPY)							
		SO2	NOx	CO	PM/PM10	TRS	VOC	SAM	HAPs
Total Proposed Modifications	▪ No. 1 Power Boiler as backup/secondary device and firing natural gas w/existing TRS scrubber as preliminary control device (MODE 1)*	124.1	---	---	---	1.09	---	7.6	0.22
	▪ No. 1 Power Boiler as backup/secondary device and firing fuel oil w/ existing TRS scrubber as preliminary control device (MODE 2)*	124.1	---	---	---	1.09	---	7.6	0.22
Existing Emissions	▪ No. 1 Power Boiler as backup/secondary device for LVHC NCG gases	0	---	---	---	0	---	0	0
	▪ Backup TRS' Scrubber for LVHC NCG gases at the No. 1 Bark Boiler	---	---	---	---	50	---	0	5.9
Total of Existing Emissions		0	---	---	---	50	---	0	5.9
TOTAL NET CHANGE		124.1**	---	---	---	-48.9	---	7.6**	-5.7

* The No. 1 Power Boiler is the backup combustion device to comply with MACT I requirements for control of LVHC gases. It will be operated in either of two modes.

Mode 1: The No. 1 Power Boiler is the backup TRS combustion device while burning natural gas and LVHC. LVHC NCG gases are routed to the existing TRS scrubber (previously used at the No. 1 Bark Boiler) as a preliminary TRS control prior to combustion.

Mode 2: LVHC NCG gases will be routed to the existing TRS scrubber (previously used at the No. 1 Bark Boiler) as a preliminary TRS control, followed by combustion in the No. 1 Power Boiler during time periods when fuel oil and LVHC gases are burned in this boiler.

' For existing emissions at the No. 1 Bark Boiler, the TRS Scrubber is the TRS Control backup control device

'' Above Significant Threshold. A Pollution Control Project (PCP) Exclusion was granted pursuant to 62-212.400(2)(a)2.b.

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FACILITY DESCRIPTION

This facility is a dissolving Kraft mill that consists of major activities areas such as: wood handling facility, pulping system, purification, chemical recovery, power house, drying/ converting/ warehouse, associated processes and equipment, and unregulated emissions units.

OPERATING LOCATION

Located east of US 19, south of SR 30, southeast of Perry, Taylor County.

RELEVANT DOCUMENTS

The documents listed below are the basis of the permit. They are specifically related to this permitting action. These documents are on file with the Department.

Air Construction Permit No. 1230001-011-AC
Application For Air Permit received April 28, 2004
Additional Information Received October 5, 2004
Comments from Applicant received January 4, 2005

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GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of the conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys not title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permitted to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

   a. Have access to and copy any record that must be kept under the conditions of the permit;

   b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

   c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

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GENERAL CONDITIONS:

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

a. A description of and cause of non-compliance; and

b. The period of non-compliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages, which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 62-4.120 and 62-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

( ) Determination of Best Available Control Technology (BACT)
( ) Determination of Prevention of Significant Deterioration (PSD)
( ) Compliance with New Source Performance Standards (NSPS)
( ) Compliance with National Emission Standards for Hazardous Air Pollutants/ Maximum Available Control Technology (MACT)

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GENERAL CONDITIONS:

14. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurement;
- the dates analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law, which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

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Perry, Florida 32347

I.D. Number: 1230001
Permit/Cert Number: 1230001-018-AC
Date of Issue: February 16, 2005
Expiration Date: February 16, 2006
County: Taylor

Subsection A. This section addresses the following emissions unit(s).

E.U. ID No.	Brief Description
002	No. 1 Power Boiler with emissions vented through a common stack with E.U. 002, 003, 004, and 019. This boiler serves as a backup destruction device for noncondensable gases (NCGs) from the sources required to be controlled by 40 CFR Part 63, Subpart S (MACT I) and State TRS regulations. The gases are routed to a pre-scrubber prior to entering the boiler for destruction. The boiler shall be operated in this mode for a period not to exceed 960 hours per year.

ESSENTIAL POTENTIAL TO EMIT (PTE) PARAMETERS

A.1. **Hours of Operation**. The hours of operation are not limited.
[Rules 62-4.160(2) and 62-210.200(PTE), F.A.C., Construction Permit No. 1230001-017-AC]

A.2. **Permitted Capacity.** The maximum heat input rate is 249 MMBtu/hr.
[Rules 62-4.160(2) and 62-210.200(PTE), F.A.C., Construction Permit 1230001-017-AC]

A.3. **Methods of Operation**. This boiler may be fired with the following fuels:

1. Natural gas.
2. No.6 fuel oil with a sulfur content that shall not exceed 2.5% by weight and may include facility generated used oil.
3. No.2 fuel oil (typically used as a pilot fuel during startups, shutdowns, and malfunctions and for dry out fires after a water wash).
4. NCGs during periods when the boiler is being utilized for their destruction. Such operation shall occur for a period not to exceed 960 hours per year.
5. Facility-generated Tall Oil blended with No. 6 fuel oil. The sulfur content of the Tall Oil shall not exceed 0.05% by weight.

[Rule 62-213.410, F.A.C.; Rule 62-210.700, F.A.C.; Construction Permit No. 1230001-011-AC; Construction Permit No. 1230001-012-AC, Construction Permit No. 1230001-017-AC]

EMISSION LIMITATIONS AND PERFORMANCE STANDARDS

{Permitting Note: Unless otherwise specified, the averaging time for these conditions is based on the specified averaging time of the applicable test method.}

A.4. **Particulate Matter Emissions**. Particulate Matter emissions shall not exceed 47.9 lbs/hr and 209.96 TPY.
[Rule 62-296.406(2), F.A.C.; Rule 62-210.200(42), F.A.C.; BACT Determination dated 01-25-90; Construction Permit 1230001-017-AC]

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number:	1230001
Permit/Cert Number:	1230001-018-AC
Date of Issue:	February 16, 2005
Expiration Date:	February 16, 2006
County:	Taylor

SPECIFIC CONDITIONS:

A.5. **Sulfur Dioxide Emissions**. Sulfur Dioxide emissions shall be limited to a maximum sulfur content of 2.5%, by weight and 671.9 lbs/hr and 2943.18 TPY.
[Rule 62-296.406(3), F.A.C.; Rule 62-210.200(42), F.A.C.; BACT Determination dated 01-25-90; Construction Permit 1230001-017-AC]

A.6. **Total Reduced Sulfur (TRS) Emissions**. When NCG gases are collected and routed to this Emissions Unit, TRS emissions shall not exceed 5 ppmvd @ 10% O2, as a 12 hour average; 2.28 lbs/hr and 1.1 TPY. TRS Emissions shall be incinerated for a minimum of 0.5 second and at a minimum of 1200°F.
[Rule 62-296.404(3)(f)1., F.A.C.; Construction Permit No. 1230001-011-AC; Construction Permit No. 1230001-012-AC]

A.7. **Visible Emissions**. Visible Emissions shall not exceed 20% opacity, except for one two-minute period per hour during which opacity shall not exceed 40 percent.

Visible emissions limits for Kraft pulp mill emissions units equipped with wet scrubbers shall be effective only if the visible emission measurement can be made without being substantially affected by moisture condensation. If the Department determines that visible emissions exceed 20 percent opacity, a special compliance test may be required in accordance with Rule 62-297.310(7)(b), F.A.C.

[Rule 62-296.406(1), F.A.C.; Rule 62-296.404(2)(b), F.A.C.; BACT Determination dated 01-25-90; Construction Permit 1230001-017-AC]

TEST METHODS AND PROCEDURES

A.8. **Sulfur Dioxide.** The permittee shall conduct sulfur dioxide emissions compliance test upon request by the Department in accordance with the requirements of Rule 62-297.310(7)(b), F.A.C. The test Method shall be EPA Method 6 incorporated and adopted by reference in Chapter 62-297, F.A.C. At all other times, compliance with the emission limit shall be demonstrated by complying with **Specific Condition A.12**.
[Rules 62-297.401(6), F.A.C.; Construction Permit No. 1230001-017-AC]

A.9. **Sulfur Content in Tall Oil.** The Permittee shall verify the sulfur content of the Tall oil by using appropriate testing methods on a quarterly basis. These records shall be maintained and reported on an annual basis.

[1]Testing required only if Tall Oil is fired during the quarter.

[Construction Permit No. 1230001-017-AC]

A.10. **TRS Emissions**. The test method for total reduced sulfur shall be EPA Method 16, or 16A incorporated and adopted by reference in Chapter 62-297, F.A.C. A compliance test shall be conducted prior to operation permit renewal during the federal fiscal year.

{Permitting Note: Buckeye shall use 80,000 acfm (design) to determine the lb/hr value in the event that an actual velocity measurement cannot be obtained during compliance testing}

[Rules 62-296.404(4)(e)3., 62-297.310(7)(a)1., (7)(a)3., (7)(a)4.b. F.A.C., 62-297.401(16), F.A.C.; Construction Permit No. 1230001-017-AC]

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number: 1230001
Permit/Cert Number: 1230001-018-AC
Date of Issue: February 16, 2005
Expiration Date: February 16, 2006
County: Taylor

SPECIFIC CONDITIONS:

A.11. **Visible Emissions.** The test method for VE shall be DEP Method 9 incorporated and adopted by reference in Chapter 62-297, F.A.C., and shall be performed once each federal fiscal year. Visible emissions limits for Kraft pulp mill emissions units equipped with wet scrubbers shall be effective only if the visible emission measurement can be made without being substantially affected by moisture condensation. If the Department determines that visible emissions exceed 20 percent opacity, a special compliance test may be required in accordance with Rule 62-297.310(7)(b), F.A.C.
[Rule 62-296.404(2)(b), F.A.C.; Rule 62-297.401(9)(c), F.A.C.; Construction Permit No. 1230001-017-AC]

COMPLIANCE MONITORING

A.12. **Particulate Matter and Sulfur Dioxide Emissions**. In lieu of stack testing, a record shall be maintained of acceptable fuel oil analyses of all fuel oil received for at least a five-year period. This information shall be reported annually.

When fuel oil or a Tall Oil/fuel oil blend is fired in this power boiler, compliance with the permit limits (in lbs/hr) shall be determined by using the fuel oil or Tall Oil/fuel oil blend usage rate [the average for each contiguous 3-hour period (i.e., 0000-0300; 0300-0600; etc.)], fuel oil sulfur content and EPA matter emissions factors to calculate the particulate matter emissions and SO_2 emissions since the particulate matter and SO_2 are a function of fuel oil sulfur content. The equations are:

1. [[9.19 (S) + 3.22]/1000] x Fuel Oil/Tall Oil Usage [gallons per hr (3-hr avg)] = lbs PM per hour
2. [[157 (S)]/1000] x Fuel Oil/Tall Oil Usage [gallons per hr (3-hr avg)] = lbs SO_2 per hour

where S = weight percent sulfur (i.e., if 2.5%, insert 2.5)

{Permitting Note: The 3-hour averaging period is consistent with the manual stack test methods (when applicable), which are normally conducted as three separate 1-hour runs and averaged to determine compliance.}

Deleted: The maximum allowed fuel sulfur content may be used as the value for S in the equations.

[Permit No. AO62-230933; Construction Permit 1230001-017-AC]

A.13. **TRS Pre-Scrubber Parameter Monitoring.** Weak wash, from the lime mud washing system, (scrubbing media), shall be continuously added to the pre-scrubber at a minimum of 50 gallons per minute based on a 3-hour average. This flow set point shall be continuously monitored and verified on an annual basis. Monitoring records shall be maintained and available for inspection by the Department.

EXCESS EMISSIONS

A.14. **Excess Emissions**. Excess emissions resulting from startup, shutdown, or malfunction of any emission units shall be permitted providing (1) best operational practices to minimize emissions are adhered to and (2) the duration of excess emissions shall be minimized but in no case exceed 8 hours in any 24-hour period unless specifically authorized by the Department for longer duration.

{Permitting note: The Excess Emissions Rule at Rule 62-210.700, F.A.C., cannot vary any requirement of a NSPS or NESHAP provision.}

A.15. Periods of excess emissions reported under 40 CFR Part 63, Subpart A shall not be a violation of 40 CFR 63.443(c) and (d), provided that the total time of excess emissions (excluding periods of startup, shutdown, or malfunction) divided by the total process operating time in a semi-annual reporting period does not exceed 4% for the No. 1 Power Boiler and No. 1 Bark Boiler combined.

[40 CFR 63.443(e)3; Construction Permit No. 1230001-011-AC; Construction Permit No. 1230001-012-AC, Construction Permit No. 1230001-017-AC]

CONTINUOUS MONITORING REQUIREMENTS

A.16. **TRS Emissions.** Total Reduced Sulfur (TRS) emissions incineration temperature shall be continuously monitored and recorded.
[Rule 62-296.404(5)(c), F.A.C.; Construction Permit No. 1230001-017-AC]

RECORDKEEPING AND REPORTING REQUIREMENTS

A.17. **Total Reduced Sulfur (TRS).** The Permittee shall submit a Total Reduced Sulfur (TRS) emissions and surrogate parameter data report to the Department postmarked by the 30th day following the end of each calendar quarter. The report shall comply with the requirements of Rule 62-296.404(6), F.A.C.
[Rule 62-296.404(6), F.A.C; Construction Permit No. 1230001-017-AC]

A.18. This emissions unit is also subject to Common Conditions C.1.- C.14.

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number: 1230001
Permit/Cert Number: 1230001-018-AC
Date of Issue: February 16, 2005
Expiration Date: February 16, 2006
County: Taylor

SPECIFIC CONDITIONS:

Subsection B. The following specific conditions apply to the emissions unit listed below:

Emissions Unit No.	Description
004	No. 1 Bark Boiler

ESSENTIAL POTENTIAL TO EMIT (PTE) PARAMETERS

B.1. **Hours of Operation**: The hours of operation are not limited.
[Rules 62-4.160(2) and 62-210.200(PTE), F.A.C.; Construction Permit No. 1230001-017-AC]

B.2. **Permitted Capacity:** Permitted Capacity. The maximum heat input rate is 300 MMBtu/hr.
[Rule 62-210.200(PTE), F.A.C.; Construction Permit No. 1230001-017-AC]

B.3. **Methods of Operation**. This boiler may be fired with the following fuels:

1. Carbonaceous Fuel consisting of wood materials such as bark, chips, sawdust and other such wood fiber material.
2. No. 6 fuel oil with a sulfur content that shall not exceed 2.5% by weight (which may contain facility generated used oil) fired as primary fuel and during startups, shutdowns, malfunctions or temporary loss of bark.
3. No. 2 fuel oil fired typically as a pilot fuel during startups, shutdowns, malfunctions and for dry out fires after a water wash. Sulfur content that shall not exceed 0.5% by weight.
4. Natural gas fired typically as a pilot fuel during startups, shutdowns, malfunctions and for dry out fires after a water wash.
5. NCGs during periods when the boiler is being utilized for their destruction.
6. Facility-generated Tall Oil blended with No. 6 fuel oil. The sulfur content of the Tall Oil shall not exceed 0.05% by weight.

[Rule 62-213.410, F.A.C.; Rule 62-210.700, F.A.C.; Permit No. AC62-141927; Construction Permit No. 1230001-011-AC; Construction Permit No. 1230001-012-AC; Construction Permit No. 1230001-017-AC]

EMISSION LIMITATIONS AND PERFORMANCE STANDARDS

{Permitting Note: Unless otherwise specified, the averaging time for these conditions is based on the specified averaging time of the applicable test method.}

B.4. **Particulate Matter Emissions**. Particulate Matter emissions shall not exceed the following:

when firing only carbonaceous fuel:

0.158 lb/MMBtu and 207 TPY

when firing only No. 6 fuel oil or Tall Oil/Fuel Oil blend:

0.1 lb/MMBtu or 24.0 lb/hr

[Construction Permit No. 1230001-017-AC]

B.5. **Sulfur Dioxide Emissions**. Sulfur Dioxide emissions shall be limited to a maximum sulfur content of 2.5% by weight, in the No. 6 fuel oil and 675.1 lbs/hr and 2957 TPY.
[Permit No. AC62-141927; Construction Permit No. 1230001-017-AC]

B.6. **Total Reduced Sulfur (TRS) Emissions**. Total Reduced Sulfur emissions shall not exceed 5 ppmvd @ 10% O_2 as a 12-hour average; 2.43 lbs/hr (based on the test method time period) and 10.64 TPY. TRS Emissions shall be incinerated for a minimum of 0.5 second and at a minimum of 1200°F.
[Rule 62-296.404(3)(f)1., F.A.C.]

B.7. **Visible Emissions.** Visible emissions shall not exceed 30% opacity, except that up to 40% Opacity is permissible for not more than 2 minutes in any one hour.

Visible emissions limits for Kraft pulp mill emissions units equipped with wet scrubbers shall be effective only if the visible emission measurement can be made without being substantially affected by moisture condensation. If the Department determines that visible emissions exceed 20 percent opacity, a special compliance test may be required in accordance with Rule 62-297.310(7)(b), F.A.C.

[Rule 62-296.410(1)(b)1., F.A.C.; Rule 62-296.404(2)(b), F.A.C.; Construction Permit No. 1230001-017-AC]

TEST METHODS AND PROCEDURES

B.8. **Particulate Matter Emissions.** The test method for particulate matter emissions shall be EPA Method 5, incorporated and adopted by reference in Chapter 62-297, F.A.C. This compliance test shall be performed once each federal fiscal year.
[Rule 62-296.410(3), F.A.C.; Rules 62-297.401(5), F.A.C.; Permit No. AC62-141927; Construction Permit No. 1230001-017-AC]

B.9. **Sulfur Dioxide Emissions**. The test method for sulfur dioxide emissions shall be EPA Method 6 incorporated and adopted by reference in Chapter 62-297, F.A.C. This compliance test shall be performed once each federal fiscal year.
[Rule 62-297.401(6), F.A.C.; Permit No. AC62-141927; Construction Permit No. 1230001-017-AC]

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number: 1230001
Permit/Cert Number: 1230001-018-AC
Date of Issue: February 16, 2005
Expiration Date: February 16, 2006
County: Taylor

SPECIFIC CONDITIONS:

B.10. **Sulfur Content in Tall Oil.** The Permittee shall verify the sulfur content of the Tall oil by using appropriate testing methods on a quarterly basis. These records shall be maintained and reported on an annual basis.

[1]Testing required only if Tall Oil is fired during the quarter.

[Construction Permit No. 1230001-017-AC]

B.11. **TRS Emissions.** The test method for total reduced sulfur emissions shall be EPA Method 16 or 16A incorporated and adopted by reference in Chapter 62-297, F.A.C. A compliance test shall be conducted prior to operation permit renewal during the federal fiscal year.
[Rule 62-297.401(16), F.A.C.; Permit No. AC62-141927; Rules 62-296.404(4)(e)3., 62-297.310(7)(a)1., (7)(a)3., (7)(a)4.b. F.A.C.; Construction Permit No. 1230001-017-AC]

B.12. **Visible Emissions.** The test method for visible emissions shall be DEP Method 9 incorporated and adopted by reference in Chapter 62-297, F.A.C., and shall be performed once each federal fiscal year.

Visible emissions limits for Kraft pulp mill emissions units equipped with wet scrubbers shall be effective only if the visible emission measurement can be made without being substantially affected by moisture condensation. If the Department determines that visible emissions exceed 20 percent opacity, a special compliance test may be required in accordance with Rule 62-297.310(7)(b), F.A.C.

[Rule 62-296.410(3), F.A.C.; Rule 62-297.401(9)(c), F.A.C.; Permit No. AC62-141927; Construction Permit No. 1230001-017-AC]

EXCESS EMISSIONS

B.13. **Excess Emissions**. Excess emissions resulting from startup, shutdown, or malfunction of any emission units shall be permitted providing (1) best operational practices to minimize emissions are adhered to and (2) the duration of excess emissions shall be minimized but in no case exceed 8 hours in any 24-hour period unless specifically authorized by the Department for longer duration.

{Permitting note: The Excess Emissions Rule at Rule 62-210.700, F.A.C., cannot vary any requirement of a NSPS or NESHAP provision.}

[Construction Permit No. 1230001-017-AC]

CONTINUOUS MONITORING REQUIREMENTS

B.14. **TRS Emissions.** Total Reduced Sulfur (TRS) emissions incineration temperature shall be continuously monitored and recorded.
[Rule 62-296.404(5)(c), F.A.C.; Permit No. AC62-141927; May 17, 1990 Amendment; Construction Permit No. 1230001-017-AC]

RECORDKEEPING AND REPORTING REQUIREMENTS

B.15. **Total Reduced Sulfur (TRS).** The Permittee shall submit a Total Reduced Sulfur (TRS) emissions and surrogate parameter data report to the Department postmarked by the 30th day following the end of each calendar quarter. The report shall comply with the requirements of Rule 62-296.404(6), F.A.C.
[Rule 62-296.404(6), F.A.C.; Permit No. AC62-141927; Construction Permit No. 1230001-017-AC]

COMMON CONDITIONS

B.16. This emissions unit is also subject to Common Conditions C.1.- C.14.

PERMITTEE:

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One Buckeye Drive,
Perry, Florida 32347

I.D. Number: 1230001
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Expiration Date: February 16, 2006
County: Taylor

SPECIFIC CONDITIONS:

Subsection C. The following specific conditions apply to the emissions unit listed below:

Emissions Unit No.	Description
002	No. 1 Power Boiler
004	No. 1 Bark Boiler

FLORIDA ADMINISTRATIVE CODE COMMON CONDITIONS

C.1. **Compliance Test Procedures**: Test procedures shall meet all applicable requirements of Chapter 62-297, F.A.C.

C.2. **Compliance Test Notification**: At least 15 days prior to the date on which each formal compliance test is due to begin, the permittee shall provide written notification of the test to the Air Compliance Section of Northeast District Department of Environmental Protection (DEP) Office. The notification must include the following information: the date, time, and location of each test; the name and telephone number of the facility's contact person who will be responsible for coordinating the test; and the name, company and telephone number of the person conducting the test.
[Rule 62-297.310(7)(a)9., F.A.C.]

C.3. **Operation During Compliance Test**: Unless otherwise stated in the applicable emission limiting standard rule, testing of emissions shall be conducted with the emissions unit operation at permitted capacity as defined in Specific Condition A.2. If it is impracticable to test at permitted capacity, an emissions unit may be tested at less than the minimum permitted capacity; in this case, subsequent emissions unit operation is limited to 110 percent of the test load until a new test is conducted. Once the unit is so limited, operation at higher capacities is allowed for no more than 15 consecutive days for the purpose of additional compliance testing to regain the authority to operate at the permitted capacity. Permitted capacity is defined as 90 to 100 percent of the maximum operation rate allowed by the permit.
[Rule 62-297.310(2)(b), F.A.C.]

C.4. **Requirements for Annual Testing**: The owner or operator shall meet all applicable requirements of Rule 62-297.310(4), F.A.C.
[Rule 62-297.310(4), F.A.C.]

C.5. **Compliance Test Reports:** Reports of the required compliance tests shall be submitted as soon as practical but no later than 45 days after the last test is completed. Each test report shall include the maximum input / production rate at which this source was operated since the most recent test.
[Rule 62-297.310(8),F.A.C.]

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

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Expiration Date: February 16, 2006
County: Taylor

SPECIFI C CONDITIONS:

C.6. **Special Compliance Tests**. When the Department, after investigation, has good reason (such as complaints, increased visible emissions or questionable maintenance of control equipment) to believe that any applicable emission standard contained in a Department rule or in a permit issued pursuant to those rules is being violated, it shall require the owner or operator of the emissions unit to conduct compliance tests which identify the nature and quantity of pollutant emissions from the emissions unit and to provide a report on the results of said tests to the Department.
[Rule 62-297.310(7)(b), F.A.C.]

C.7. **Required Equipment.** The owner or operator of an emissions unit for which compliance tests are required shall install, operate, and maintain equipment or instruments necessary to determine process variables, such as process weight input or heat input, when such data are needed in conjunction with emissions data to determine the compliance of the emissions unit with applicable emission limiting standards.
[Rule 62-297.310(5)(a), F.A.C.]

C.8. **Accuracy of Equipment**: Equipment or instruments used to directly or indirectly determine process variables, including devices such as belt scales, weight hoppers, flow meters, and tank scales, shall be calibrated and adjusted to indicate the true value of the parameter being measured with sufficient accuracy to allow the applicable process variable to be determined within 10% of its true value.
[Rule 62-297.310(5)(b), F.A.C.]

C.9. **Annual Operating Report**: The owner or operator shall submit an Annual Operating Report for Air Pollutant Emitting Facility (DEP Form No. 62-210.900(5)) to the Northeast District Department of Environmental Protection (DEP) Office annually pursuant to Rule 62-210.370(3), F.A.C.

COMMON CONDITIONS

C.10. This permit shall supercede previous construction permits issued for these emission units and activities only to the extent of incorporating the conditions of this permit.

C.12. Any revision(s) to a permit (and application) must be submitted to the Department, in writing, and approved by the Department prior to implementation.

C.13. The permittee shall submit an application for a Title V Permit Revision no later than 180 days after these emissions units commence operation under the terms of this permit.
[Rule 62-213.420(1)(a)5., F.A.C.]

C.14. All tests, notifications or other submittals required by this permit shall be submitted to the:

Department of Environmental Protection
Northeast District – Air Program
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256
Telephone: 904/807-3300
Fax: 904/448-4363

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number:	1230001
Permit/Cert Number:	1230001-018-AC
Date of Issue:	February 16, 2005
Expiration Date:	February 16, 2006
County:	Taylor

SPECIFIC CONDITIONS:

Executed in Jacksonville, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

_____
Christopher L. Kirts, P.E.
District Air Program Administrator

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

David B. Struhs
Secretary

October 8, 2001

NOTICE OF PERMIT

CERTIFIED-RETURN RECEIPT

Mr. Howard Drew, V. P., Wood Cellulose Manufacturing
Buckeye Florida, Limited Partnership
One Buckeye Drive
Perry, Florida 32348-7702

Dear Mr. Drew:

Taylor County - AP
Buckeye Florida, Limited Partnership
MACT I Compliance:
No. 2 Brown Stock Washer System
No. 4 Recovery Boiler
No. 4 Smelt Dissolving Tank
Nos. 1 and 2 Lime Slakers

Enclosed is Permit Number 1230001-014-AC to construct the subject air pollution emissions unit(s), issued pursuant to Section 403.087, Florida Statutes (FS).

Any party to this order has the right to seek judicial review of it under section 120.68 of the Florida Statutes, by filing a notice of appeal under rule 9.110 of the Florida rules of Appellate Procedure with the clerk of the Department of Environmental Protection in the Office of General Counsel, Mail Station 35, 3900 Commonwealth boulevard, Tallahassee, Florida, 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice must be filed within thirty days after this order is filed with the clerk of the Department.

Executed in Jacksonville, Florida.

FILING AND ACKNOWLEDGEMENT
FILED, on this date, pursuant to §120.52 Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.
Dorothy Jernigan 10/11/01
Clerk Date

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Christopher L. Kirts, P. E.
District Air Program Administrator

CLK:RFS

cc: Carla Ferguson, Buckeye Florida, Limited Partnership
David A. Buff, P.E., Golder Associates, Inc.

OCT 12 2001

"More Protection, Less Process"

Printed on recycled paper.

Department of Environmental Protection

Jeb Bush
Governor

Northeast District
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256-7590

David B. Struhs
Secretary

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number:	1230001
Permit/Cert Number:	1230001-014-AC
Date of Issue:	October 8, 2001
Expiration Date:	October 8, 2006
County:	Taylor
Latitude/Longitude:	30° 03' 59" N; 83° 33' 12" W
UTM:	E-(17) 256.7; N-3328.7
Project:	MACT I Compliance: No. 2 Brown Stock Washer System No. 4 Recovery Boiler No. 4 Smelt Dissolving Tank Nos. 1 & 2 Lime Slakers

This permit is issued under the provisions of Chapter(s) 403, Florida Statutes, and Florida Administrative Code Rule(s) 62-210, 62-212, 62-296, 62-297 and 62-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the department and made a part hereof and specifically described as follows:

For the installation and implementation of equipment necessary for compliance with the kraft pulping standards of 40 CFR Part 63, Subpart S (MACTI), the emission units are identified below:

Emission Unit 011: No. 4 Recovery Boiler
Emission Unit 023: No. 4 Smelt Dissolving Tank with a scrubber to control emissions
Emission Unit 025: Nos. 1 &2 Lime Slakers with a wet scrubber to control particulate matter emissions
No. 2 Brown Stock Washer System

The Pulping System – MACT I includes those sources regulated under MACT I: Nos. 1 and 2 Batch Digester systems, the Turpentine Recovery system (includes the turpentine Condenser, Decanter, Weir Box, and Underflow Tank), Multiple Effect Evaporator systems (Nos. 1-4), the Pulping Process Condensate Collection System, the No 1 and No. 2 Brown Stock Washers and associated filtrate tanks, foam towers, knotters, screens, and storage chests.

Project Description:

Buckeye Florida, Limited Partnership – Foley Mill, was granted a Pollution Control Project (PCP) Exclusion for this project pursuant to the requirements of Rule 62-212.400(2)(a)2.b, F.A.C.

Buckeye proposes to replace the existing 3-stage, rotary drum washer and decker at the No. 2 Mill Brown Stock Washing system with a new multiple-stage, pressure-type, brown stock washer with a rated capacity of 1100 metric tons (1213 short tons) ADUP per day.

The No. 2 Brown Stock Washing system after completion of the project, will consist of the following:

- Primary Knotters (pressure type) New
- Secondary Knotters (pressure type) New
- Knot and shives tank Existing
- Closed screening system New

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
)y, Florida 32347

I.D. Number:	1230001
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Date of Issue:	October 8, 2001
Expiration Date:	October 8, 2006
County:	Taylor

Project Description Continued:

• Refined rejects chest	New
• Rejects refiner	New
• Pressure brown stock washer	New
• Filtrate Tank	Existing
• Pulp Storage Tanks	Existing

The filtrate from the new brown stock washer will allow for the recovery of additional black liquor solids (previously sewered) to be processed in the No. 4 Recovery Boiler, which in turn will affect the No. 4 Smelt Dissolving Tanks. Buckeye has requested an increase in the BLS loading to the No. 4 Recovery Boiler by 10,000 lb/hr, and the process rate at the lime slakers by 6751 lb/hr total solids. The potential increases in the No. 4 Lime Kiln, the chemical recovery area, and the causticizers will not require an increase in the current permitted rates for these sources. The project will reduce the emissions of hazardous air pollutants, volatile organic compounds, and total reduced sulfur compounds.

The new brown stock washer will be subject to the requirements of 40 CFR Part 60, Subpart BB. However, the facility received a temporary variance by EPA Region IV, from the requirement until April 16, 2006 due to the fact that this mill system will eventually be integrated into a single High Volume Low Concentration (HVLC) non-condensible gas system with the No. 1 Mill Brown Stock Washing System. The proposed changes to the No. 1 BSWS will be submitted by Buckeye at a later date.

The No. 2 Mill Brown Stock Washer System will also be subject to the requirements of 40 CFR 63, Subpart S.

Located: Route 17, Perry, Taylor County, Florida.

In accordance with:

Construction permit application received August 3, 2000
Additional Information Received November 13, 2000
Additional information received February 12, 2001
Comments received from Applicant dated April 19, 2001
Additional Information received June 4, 2001
Comments received from Applicant on August 24, 2001

PF ITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number: 1230001
Permit/Cert Number: 1230001-014-AC
Date of Issue: October 8, 2001
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County: Taylor

Project Description Continued:

Summary of the net emissions changes as a result of this proposed project:

		Pollutants Emission Rate (TPY)											
		SO2	NOx	CO	PM	PM10	TRS	VOC	SAM	HAPs	Lead	Hg	Be
Total Proposed Modifications	• No. 2 Mill Brown Stock Washing System	—	—	—	—	—	2.83	37.60	—	16.70	—	—	—
	• No. 4 Recovery Boiler [2]	773.8	457.2	3106.6	496.7	385.4	20.7	45.7	38.7	36.75	2.0E-02	1.1E-02	9.8E-04
	• No. 4 Smelt Tank[2]	4.69	9.67	—	132.2	118.3	9.4	18.2	0.29	5.46	5.0E-03	5.3E-05	4.1E-05
	• No. 4 Lime Kiln [2]	136.88	299.76	56.12	87.60	87.60	11.56	32.30	8.38	3.42	4.1E-04	5.7E-04	1.0E-04
	• Lime Slaker System [2]	—	—	—	18.2	—	—	11.7	—	32.74	—	—	—
	• Lime Storage Bins	—	—	—	1.5	1.5	—	—	—	—	—	—	—
	• White Liquor Pressure Filter [2]	—	—	—	—	—	0.1	0.8	—	2.3	—	—	—
	• Lime Mud Pressure Filter [2]	—	—	—	—	—	0.1	1.0	—	4.7	—	—	—
Total of Future Emissions:		915.4	766.7	3162.7	736.2	592.8	44.7	147.3	47.4	102.0	2.5E-02	1.2E-02	1.1E-03
Existing Emissions	• Pulping Area General Decker[2]	—	—	—	—	—	12.8	15.4		20.3	—	—	—
	• Brown Stock Washing System[1]												
	• No. 4 Recovery Boiler	632.4	368.4	2503.0	115.0	89.2	68.6	107.8		247.5	—	—	—
	• No. 4 Smelt Tank	3.8	7.8	—	23.5	21.1	1.9	36.8	31.2	29.6	1.6E-02	8.8E-03	7.9E-04
	• No. 4 Lime Kiln	87.7	191.9	35.9	12.5	12.5	6.0	14.6	0.2	4.4	4.0E-03	4.3E-05	3.3E-05
	• Lime Slaker System	—	—	—	16.7	—	1.47	20.7	5.4	2.2	2.6E-04	3.7E-04	6.5E-05
	• Lime Storage bins	—	—	—	1.3	1.3	—	6.9	—	19.2	—	—	—
	• White Liquor Pressure Filter	—	—	—	—	—	—	—	—	—	—	—	—
	• Lime Mud Pressure Filter	—	—	—	—	—	—	0.4	—	1.4	—	—	—
Total of Existing Emissions:		714.99	568.1	2538.9	169.0	124.1	90.8	203.2	36.8	327.4	2.0E-02	9.2E-03	8.9E-04
TOTAL NET CHANGE:		200.5[3]	198.6[3]	623.8[3]	567.2[3]	468.7[3]	-46.1	-55.9	10.6[3]	-225.4	5.2E-03	2.4E-03	2.3E-04

[1] To be removed from operation
[2] Based on proposed changes to both the No. 1 and No. 2 Brown Stock Washers
[3] **Above Significant Threshold. A Pollution Control Project (PCP) Exclusion was granted pursuant to 62-212.400(2)(a)2.b.**

PERMITTEE:

Buckeye Florida, Limited Partnership
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Perry, Florida 32347

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County:	Taylor

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of the conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys not title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does no relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permitted to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

   a. Have access to and copy any record that must be kept under the conditions of the permit;

   b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

   c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

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GENERAL CONDITIONS:

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

   a. A description of and cause of non-compliance; and

   b. The period of non-compliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages, which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 62-4.120 and 62-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

( ) Determination of Best Available Control Technology (BACT)
( ) Determination of Prevention of Significant Deterioration (PSD)
(X) Compliance with New Source Performance Standards (NSPS)
(X) Compliance with National Emission Standards for Hazardous Air Pollutants/ Maximum Available Control Technology (MACT)

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GENERAL CONDITIONS:

14. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact places, and time of sampling or measurements;
- the person responsible for performing the sampling or measurement;
- the dates analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law, which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

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SPECIFIC CONDITIONS:

The following conditions apply to Emission Units 046, Emission Point 01: No 2 Brown Stock Washing System:

1. The permittee shall comply with the requirements of 40 CFR Part 63, Subpart A- General Provisions as indicated in Table 1 of Subpart S.
[40 CFR 63.440(g)].

2. Total HAP emissions from the following equipment systems shall be controlled as specified in Specific Condition No. 3:

   - No. 2 Mill Brown Stock Washing System

3. Each equipment system listed in Specific Condition No. 2 shall be enclosed and vented into a closed-vent system and routed to a boiler or recovery furnace for control of total HAP emissions no later than the HVLC system compliance date of April 16, 2006. The enclosures and closed-vent system shall meet the requirements specified in Specific Condition No. 5. The HAP emission stream shall be introduced with the primary fuel or into the flame zone; or controlled in a boiler with a heat input capacity greater than or equal to 150 million British thermal Units per hour by introducing the HAP emission stream with the combustion air.
[40 CFR 63.443(c), 40 CFR 63.443(d)(4)(i) and (ii)].

4. Periods of excess emissions reported under Specific Condition No. 1 shall not be a violation of Specific Condition No. 3 provided that the time of excess emissions (excluding periods of startup, shutdown, or malfunction) divided by the total process operating time in a semi-annual reporting period does not exceed 4% for the boiler or recovery furnace. [40 CFR 63.443(e)(3)]

   Excess emissions due to startup, shutdown or malfunction are allowed for up to eight (8) hours in any 24 hour period unless otherwise requested and approved, provided effort is made to minimize emissions and duration in accordance with Rule 62-210.700 F.A.C.

Standards for enclosures and closed-vent systems:

5. Each enclosure and closed-vent system specified in Specific Condition No. 3 for capturing and transporting vent streams that contain HAP shall meet the following requirements no later than April 16, 2006.

   (a) Each enclosure shall maintain negative pressure at each enclosure or hood opening as demonstrated by the procedures specified in Specific Condition No. 10.

   (b) Each component of the closed-vent system used to comply with Specific Condition No. 3 that is operated at positive pressure and located prior to a control device shall be designed for and operated with no detectable leaks as indicated by an instrument reading of less than 500 parts per million by volume above background, as measured by the procedures specified in Specific Condition No. 9.

   (c) Each bypass line in the closed-vent system that could divert vent streams containing HAP to the atmosphere without meeting the emission limitations in §§63.443 and §§63.445 shall comply with one of the following requirements:
      (1) On each bypass line, the permittee shall install, calibrate, maintain, and operate according to manufacturer's specifications a flow indicator that provides a record of the presence of gas stream flow in the bypass line at least once every 15 minutes. The flow indicator shall be installed in the bypass line in such a way as to indicate flow in the bypass line; or

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SPECIFIC CONDITIONS:
Specific Condition No. 5 Continued:

(2) For bypass line valves these are not computer controlled, the permittee shall maintain the bypass line valve in the closed position with a car seal or a seal placed on the valve or closure mechanism in such a way that valve or closure mechanism cannot be opened without breaking the seal.

Note: Buckeye plans on demonstrating compliance with Specific Condition No.5(c)(1) by monitoring computer (DCS) controlled automatic valves with a continuous indication of any venting and the capability to record venting periods at least once every 15 minutes on each bypass line. The bypass lines are (2) two ten-inch vent collection lines located in the pulping and power operating departments.
[40 CFR 63.450]

Monitoring Requirements

6. Each enclosure and closed-vent system used to comply with Specific Condition No.5 shall comply with the following requirements no later than April 16, 2006:

(1) For each enclosure opening, a visual inspection of the closure mechanism specified in Specific Condition No. 5.(a) shall be performed at least once every 30 days to ensure the opening is maintained in the closed position and sealed.

(2) Each closed-vent system shall be visually inspected at least once every 30 days and at other times as requested by the Administrator. The visual inspection shall include inspection of ductwork, piping, enclosures, and connections to covers for visible evidence of defects.

(3) For positive pressure closed-vent systems or portions of closed-vent systems, demonstrate no detectable leaks as specified in Specific Condition No.5.(b) measured initially and annually by the procedures in Specific Condition No. 9.

(4) Demonstrate initially and annually that each enclosure opening is maintained at negative pressure as specified in Specific Condition No. 10.

(5) The valve or closure mechanism specified in Specific Condition No. 5.(c)(2) shall be inspected at least once every 30 days to ensure that the valve is maintained in the closed position and the emission point gas stream is not diverted through the bypass line.

(6) If an inspection required by Specific Conditions Nos. 6.(1) through 6.(5) identifies visible defects in ductwork, piping, enclosures or connections to covers required in Specific Condition No.5, or if an instrument reading of 500 parts per million by volume or greater above background is measured, or if enclosure openings are not maintained at negative pressure, then the following corrective actions shall be taken as soon as practicable.

(i) A first effort to repair or correct the closed-vent system shall be made as soon as practicable but no later than 5 calendar days after the problem is identified.

(ii) The repair or corrective action shall be completed no later than 15 calendar days after the problem is identified. Delay of repair or corrective action is allowed if the repair or corrective action is technically infeasible without a process unit shutdown or if the owner or operator determines that the emissions resulting from immediate repair would be greater than the emissions likely to result from delay of repair. Repair of such equipment shall be completed by the end of the next process unit shutdown.

[40 CFR 63.453(k)]

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SPECIFIC CONDITIONS:

7. For each applicable enclosure opening, closed-vent system, and closed collection system, the permittee shall prepare and maintain a site-specific inspection plan including a drawing or schematic of the components of applicable affected equipment and shall record the following information for each inspection:
(1) Date of inspection;
(2) The equipment type and identification;
(3) Results of negative pressure tests for enclosures;
(4) Results of leak detection tests;
(5) The nature of the defect or leak and the method of detection (i.e., visual inspection or instrument detection);
(6) The date the defect or leak was detected and the date of each attempt to repair the defect or leak;
(7) Repair methods applied in each attempt to repair the defect or leak;
(8) The reason for the delay if the defect or leak is not repaired within 15 days after discovery;
(9) The expected date of successful repair of the defect or leak if the repair is not completed within 15 days;
(10) The date of successful repair of the defect or leak;
(11) The position and duration of opening of bypass line valves and the condition of any valve seals; and
(12) The duration of the use of bypass valves on computer controlled valves.
[40 CFR 63.454(b)]

8. Vent sampling port locations and gas stream properties. For purposes of selecting vent sampling port locations and determining vent gas stream properties, required in §§63.443, the permittee shall comply with the applicable procedures specified in §63.457(b). [40 CFR 63.457(b)]

9 Detectable leak procedures. To measure detectable leaks for closed-vent systems as required in Specific Condition No.5 (b), the permittee shall comply with the requirements of §63.457(d).
[40 CFR 63.457(d)]

10. Negative pressure procedures. To demonstrate negative pressure as required in Specific Condition No.5 (a) at process equipment enclosure openings, the permittee shall comply with the requirements of §63.457(e).
[40 CFR 63.457(e)]

The following conditions apply to Emission Units 011, The No. 4 Recovery Boiler:

11. Permitted Capacity. Upon installation of the No. 2 BSW, the maximum operating rate at this emissions unit shall not exceed 133,825 lbs (BLS)/hr, where BLS is Black Liquor Solids fired.

(Permitting note: The capacity limitations have been placed in each permit to identify the capacity of each emissions unit for purposes of confirming that emissions testing is conducted within 90-100 percent of the emissions unit's rated capacity (or to limit future operation to 110 percent of the test load), to establish appropriate limits and to aid in determining future rule applicability.)

[Rules 62-4.160(2) and 62-210.200(PTE), F.A.C.]

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SPECIFIC CONDITIONS:

12. Methods of Operation. This boiler is fired with:

    1. Black liquor solids (BLS).

    2. No. 6 fuel oil with a sulfur content that shall not exceed 2.5% by weight (which may contain facility generated used oil) fired as primary fuel during startups, shutdowns, malfunctions or temporary loss of BLS.

    3. No. 2 fuel oil fired typically as a pilot fuel during startups, shutdowns, malfunctions and for dry out fires after a water wash. Sulfur content that shall not exceed 0.5% by weight. The usage of #2 fuel oil is limited to 50,000 gallons per year, unless otherwise requested.

    4. Natural gas fired typically as a pilot fuel during startups, shutdowns, malfunctions and for dry out fires after a water wash.

    [Rule 62-213.410, F.A.C.; Rule 62-210.700, F.A.C.; Title V Permit No. 120001-007-AV]

Emission Limitations and Standards

13. Particulate Matter Emissions shall not exceed 3 lbs/3000 lbs BLS; 113.40 lbs/hr (based on the test method time period) and 496.69 TPY. The amount of BLS fired in this recovery boiler shall be continuously monitored and recorded.
    [Final Title V Permit No. 1230001-007-AV]

14. Total Reduced Sulfur (TRS) emissions shall not exceed 5.0 ppmvd @ 8% O2 as a 12-hr avg.; 4.73 lbs/hr (based on the test method time period) and 20.71 TPY.
    [62-296.404(3)(c)b.]

15. Visible Emissions shall not exceed 45% opacity for a 6-minute average, except for up to 60% for one 6-minute period per hour is allowed.
    [Rule 62-296.404(1), F.A.C.; Final Title V Permit No. 1230001-007-AV]

Test Methods and Procedures.

16. Particulate Matter emissions shall be tested using EPA Method 5, incorporated and adopted by reference in Chapter 62-297, F.A.C.
    [Rule 62-296.404(4)(a)2., F.A.C.; Rules 62-297.401(5), F.A.C]

17. Visible Emissions shall be tested using EPA Method 9 incorporated and adopted by reference in Chapter 62-297.
    [Rule 62-296.404(4)(a)1., F.A.C.; Rules 62-297.401(9), F.A.C.]

Testing Frequency.

18. The permittee shall conduct a formal compliance test for pollutants identified in Specific Condition Nos. 13. and 15, within 60 days after the maximum operation rate for the No. 2 Mill Brown Stock Washer has been achieved, but not later than 180 days after its initial startup. At least 15 days prior to the date on which each formal compliance test is to begin, the permittee shall notify the Department of the date, time, and place of each test, and the test contact person who will be responsible for coordinating and having the test conducted.
    [FAC Rules 297.310(7)(a)1 and 297.310(7)(a)9]

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Monitoring Requirements.

19. Total Reduced Sulfur (TRS) emissions continuous monitoring shall comply with the applicable requirements in Rule 62-296.404(5), F.A.C.

Recordkeeping and Reporting Requirements.

20. Total Reduced Sulfur (TRS) emissions continuous monitoring report shall comply with the applicable requirements in Rule 62-296.404(6), F.A.C.

NSPS, Subpart BB Requirements:

21. The TRS gases from the brown stock washer shall be combusted in a boiler meeting the requirements of Specific Condition No. 22 no later than April 16, 2006, pursuant to the NSPS Variance granted by EPA Region IV on 12/12/00. [40 CFR 60.283(a)(1)]

Test Method and Procedures:

22. The TRS gases from the brown stock washer must be subjected to a minimum temperature of 1200°F and a 0.5-second residence time in either the recovery furnace or boiler used to combust the brown stock washer system gases.
[40 CFR 60.283(a)(1)(iii)]

23. The permittee shall comply with the applicable requirements of 40 CFR Part 60, Subpart A – General Provisions.

The following conditions apply to Emission Units 023, The No. 4 Smelt Dissolving Tank:

24. Permitted Capacity. The maximum allowed operation rate is 133,825 lbs (BLS)/hr, based on the maximum Black Liquor Solids fired in the No.4 Recovery Boiler.

{Permitting note: The capacity limitations have been placed in each permit to identify the capacity of each emissions unit for purposes of confirming that emissions testing is conducted within 90-100 percent of the emissions unit's rated capacity (or to limit future operation to 110 percent of the test load), to establish appropriate limits and to aid in determining future rule applicability.}

[Rules 62-4.160(2) and 62-210.200(PTE), F.A.C.]

25. Particulate Matter emissions shall not exceed the Process Weight Table (PWT); 30.19 lbs/hr (based on the test method time period) and 132.22 TPY, which is the existing permitted emission rate.
[Final Title V Permit No. 1230001-007-AV]

26. Total Reduced Sulfur (TRS) emissions shall not exceed 0.048 lb TRS/3000 lbs BLS as H2S; 2.14 lbs/hr (based on the test method time period) and 9.4 TPY. The amount of black liquor solids fired in the recovery boiler associated with each SDT shall be continuously monitored and recorded.
[Rule 62-296.404(3)(d)1]

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SPECIFIC CONDITIONS:

27. Visible Emissions shall not be greater than 20% opacity. Visible emissions limits for Kraft pulp mill emissions units equipped with wet scrubbers shall be effective only if the visible emission measurement can be made without being substantially affected by moisture condensation. If the Department determines that visible emissions exceed 20 percent opacity, a special compliance test may be required in accordance with Rule 62-296.404(2)(b), F.A.C. [Rule 62-296.404(2)(b), F.A.C.; Rule 62-297.310(7)(b), F.A.C.]

28. Particulate Matter emissions testing shall be by using EPA Method 5, incorporated and adopted by reference in Chapter 62-297, F.A.C.
[Rule 62-296.404(4)(c)1]

29. Visible Emissions (see Specific Condition No. 30) shall be tested using EPA Method 9, incorporated and adopted by reference in Chapter 62-297, F.A.C.
[Rule 62-296.404(2)(b), F.A.C.; Rule 62-297.401(9), F.A.C.]

30. Total Reduced Sulfur emissions testing shall be determined using EPA Method 16, 16A or 16B incorporated and adopted by reference in Chapter 62-297, F.A.C.
[Rule 62-296.404(4)(c)3. And 62-297.401(16), F.A.C.]

Monitoring Requirements.

31. The permittee shall comply with the monitoring requirements stated in the Final Title V Permit No. 1230001-007-AV for this emissions unit.

Testing Frequency.

32. The permittee shall conduct a formal compliance test for pollutants identified in Specific Condition Nos. 25. – 27., within 60 days after the maximum operation rate at which the No. 2 Mill Brown Stock Washer has been achieved, but not later than 180 days after its initial startup. At least 15 days prior to the date on which each formal compliance test is to begin, the permittee shall notify the Department of the date, time, and place of each test, and the test contact person who will be responsible for coordinating and having the test conducted.
[FAC Rules 297.310(7)(a)1 and 297.310(7)(a)9]

The following conditions apply to Emission Units 025, The Nos. 1 & 2 Lime Slakers:

33. Permitted Capacity. The maximum allowed operation rate is 243,000 lbs/hr of lime solids plus green liquor solids (60,886 and 182,114 lb/hr, respectively).

{Permitting note: The capacity limitations have been placed in each permit to identify the capacity of each emissions unit for purposes of confirming that emissions testing is conducted within 90-100 percent of the emissions unit's rated capacity (or to limit future operation to 110 percent of the test load), to establish appropriate limits and to aid in determining future rule applicability.}

[Rules 62-4.160(2) and 62-210.200(PTE), F.A.C.]

35. Particulate Matter Emissions shall not exceed 2.08 lbs/hr (based on the test method time period) and 9.13 TPY.
[Final Title V Permit No. 1230001-007-AV]

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County:	Taylor

SPECIFIC CONDITIONS:

35. Visible Emissions shall not be greater than 20% opacity. Visible emissions limits for Kraft pulp mill emissions units equipped with wet scrubbers shall be effective only if the visible emission measurement can be made without being substantially affected by moisture condensation. If the Department determines that visible emissions exceed 20 percent opacity, a special compliance test may be required in accordance with Rule 62-296.404(2)(b), F.A.C. Rule 62-296.404(2)(b), F.A.C.; Rule 62-297.310(7)(b), F.A.C.]

36. Particulate Matter Emissions. In lieu of particulate emissions testing, the scrubber water pressure shall be maintained at 20 psig or higher. Record the pressure at the start and end of all visible emissions compliance tests. [Final Title V Permit No. 1230001-007-AV]

37. Visible Emissions testing shall be by using EPA Method 9, incorporated and adopted by reference in Chapter 62-297, F.A.C.
[Rule 62-297.401(9), F.A.C.]

Continuous Monitoring Requirements

38. Particulate Matter Emissions surrogate parameter, the scrubber water pressure, shall be maintained at 20 psig or higher and monitored by a device with an accuracy of (+/-) 15 percent.
[Final Title v Permit No. 1230001-007-AV]

Recordkeeping and Reporting Requirements

39. Particulate Matter Emissions surrogate parameter monitoring shall be reported with all visible emissions compliance tests.
[Final Title V Permit No. 1230001-007-AV]

The following conditions apply to Emission Units 011, 023, 025, and 046:

40. The ID Number and Project Name for this source shall be used on all correspondences.

41. This permit shall supercede previous permits issued for these emission units and activities only to the extent of incorporating the conditions of this permit. Specifically as follows:

Emission Unit	Permit Number	Specific Condition Number(s)
No. 4 Recovery Boiler	Permit No. AO62-208309	1, 4
No. 4 Smelt Dissolving Tank	Permit No. AC62-141926	2, 3
Nos. 1&2 Lime Slakers	Permit No. AC62-143536	2

42. The hours of operation are not restricted for these emissions units, i.e. 8,760 hours/year.
[Final Title V Permit 1230001-007-AV]

PERMITTEE:

Buckeye Florida, Limited Partnership
One Buckeye Drive,
Perry, Florida 32347

I.D. Number:	1230001
Permit/Cert Number:	1230001-014-AC
Date of Issue:	October 8, 2001
Expiration Date:	October 8, 2006
County:	Taylor

SPECIFIC CONDITIONS:

Terms/Definitions:

43. The term "immediately" as used in General Condition Number 8 of this permit shall mean "within 24 hours or the next working day". [Applicant Request dated 4/18/01]

44. The term "work site" as used in General Condition Number 12 of this permit shall mean "facility". [Applicant Request dated 4/18/01]

45. The term "monitoring information" as used in General Condition Number 14.b. shall include electronic data. [Applicant Request dated 4/18/01]

Submittals:

46. All reports, tests, notifications or other submittals required by this permit shall be submitted to the:

Department of Environmental Protection
Northeast District – Air Program
7825 Baymeadows Way, Suite B200
Jacksonville, Florida 32256
Telephone: 904/448-4310
Fax: 904/448-4366

47. The permittee shall submit an application for a Title V permit revision, or Title V permit renewal, as applicable, no later than November 30, 2006 [1] for the High Volume Low Concentration system. [Final Title V Permit No. 1230001-007-AV issued November 8, 2000]

[1] Note: If 40 CFR Part 63 is modified to allow for applicable time extension requests, the applicant may apply for an extension to the respective deadlines.

Executed in Jacksonville, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Christopher L. Kirts, P.E.
District Air Program Administrator

FILING AND ACKNOWLEDGEMENT
FILED, on this date, pursuant to §120.52 Florida Statutes, with the designated Department Clerk, receipt is hereby acknowledged.
Dorothy Barnefield 10/11/01
Clerk Date

ATTACHMENT C

REVISED CONTEMPORANEOUS AND DEBOTTLENECKING EMISSIONS ANALYSIS AND PSD APPLICABILITY TABLES

TABLE 3-3
CONTEMPORANEOUS AND DEBOTTLENECKING EMISSIONS ANALYSIS AND PSD APPLICABILITY
PHASE I, BUCKEYE ENERGY PROJECT, BUCKEYE FLORIDA

Source Description	EU ID	Pollutant Emission Rate (TPY)											
		SO_2	NO_x	CO	PM	PM_{10}	$PM_{2.5}$	VOC	TRS	SAM	Lead	Mercury	Fluoride
PROJECTED ACTUAL EMISSIONS													
No. 2 Recovery Boiler w/ NDCE	006	343.41	318.81	879.78	129.37	92.24	64.42	18.16	14.24	15.27	3.39E-03	1.10E-04	0.024
BL Concentrator for No. 2 Recovery Boiler		15.01	--	--	--	--	--	0.63	0.15	0.67	--	--	--
BL Storage Tank		--	--	--	--	--	--	0.48	0.79	--	--	--	--
No. 3 Recovery Boiler w/ DCE [a]	007	544.46	207.42	195.75	33.84	25.98	20.35	33.67	12.13	23.96	4.11E-03	8.19E-05	0.031
BLO System for No. 3 Recovery Boiler [a]		--	--	--	0.80	0.80	0.78	19.16	15.04	--	--	--	--
No. 1 Power Boiler [a]	002	585.88	107.09	14.38	41.48	35.69	18.81	0 86	--	25.78	2.69E-03	2.52E-04	0.075
No. 2 Power Boiler [a]	003	0.07	33.43	9.23	0.91	0.91	0.84	0.60	--	--	5 49E-05	3 10E-05	--
No 1 Bark Boiler [a]	004	63.94	205.06	547.15	129.94	127.35	127.84	31.00	--	2.81	3.68E-02	6.23E-04	0.009
No 2 Bark Boiler [a]	019	70.09	455.61	1,226 69	345.96	339.04	346.93	69.51	--	1.75	8.20E-02	1 40E-03	0.012
Total- Future Potential		**1,622.86**	**1,327.43**	**2,872.99**	**682.30**	**622.00**	**579.96**	**174.08**	**42.34**	**70.24**	**1.29E-01**	**2.50E-03**	**0.152**
BASELINE ACTUAL EMISSIONS													
No. 2 Recovery Boiler w/ DCE	006	613.59	245.03	243.63	73.61	56.52	33.58	41.98	16.71	27.00	4.93E-03	7.88E-05	0.024
BLO System for No. 2 Recovery Boiler		--	--	--	0 98	0.98	0.98	23.91	18.42	--	--	--	--
No. 3 Recovery Boiler w/ DCE	007	544.46	207.42	195.75	33.84	25.98	20.35	33.67	12.13	23.96	4.11E-03	8.19E-05	0.031
BLO System for No. 3 Recovery Boiler		--	--	--	0.80	0.80	0.78	19.16	15.04	--	--	--	--
No. 1 Power Boiler	002	585.88	107.09	14.38	41.48	35.69	18.81	0 86	--	25.78	2 69E-03	2 52E-04	0.075
No. 2 Power Boiler	003	0.07	33.43	9.23	0.91	0.91	0 84	0.60	--	--	5.49E-05	3.10E-05	--
No. 1 Bark Boiler	004	63 94	205.06	547.15	129.94	127.35	127.84	31.00	--	2.81	3.68E-02	6.23E-04	0.009
No. 2 Bark Boiler	019	70.09	455 61	1,226.69	345.96	339.04	346.93	69.51	--	1.75	8 20E-02	1 40E-03	0.012
Total- BASELINE ACTUAL		**1,878.03**	**1,253.65**	**2,236.84**	**627.52**	**587.27**	**550.10**	**220.69**	**62.30**	**81.30**	**1.31E-01**	**2.47E-03**	**0.152**
Increase Due to Project		**-255.17**	**73.78**	**636.14**	**54.78**	**34.73**	**29.86**	**-46.61**	**-19.96**	**-11.06**	**-1.55E-03**	**3.12E-05**	**0.000**
PSD SIGNIFICANT EMISSION RATE		40	40	100	25	15	NA	40	10	7	0 6	0.1	3.0
Netting Triggered?		No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No
CONTEMPORANEOUS EMISSION CHANGES													
Tall Oil as Fuel· 1230001-017-AC (2/16/05)		-- [b]	--	--	--	--	-- [b]	-- [b]	-- [b]	-- [b]	-- [b]	-- [b]	-- [b]
No 1 Power Boiler NCG/TRS Destruction 1230001-018-AC (2/16/05)		124.1 [b,c]	--	--	--	--	-- [b]	-- [b]	-48.9 [b]	7.6 [b,c]	-- [b]	-- [b]	-- [b]
No. 2 Brown Stock Washer MACT I Compliance 1230001-014-AC (Completed early 2006)		200.5 [b,c]	198.6 [c]	623.8 [c]	567.2 [c]	468.7 [c]	-- [b]	-55 9 [b]	-46.1 [b]	10.6 [b,c]	5 2E-03 [b]	2.4E-03 [b]	-- [b]
Total Contemporaneous Emission Changes		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
TOTAL NET CHANGE		**-255.17**	**73.78**	**636.14**	**54.78**	**34.73**	**29.86**	**-46.61**	**-19.96**	**-11.06**	**-1.55E-03**	**3.12E-05**	**0.000**
PSD SIGNIFICANT EMISSION RATE		40	40	100	25	15	NA	40	10	7	0.6	0.1	3.0
PSD REVIEW TRIGGERED?		No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No

[a] This emissions unit is not affected during Phase I of the Buckeye Energy Project, and so the projected actual emissions are equal to the baseline actual emissions.

[b] Project does not result in a significant emissions increase for this pollutant. Therfore, netting is not triggered for this pollutant. The total for this pollutant is not included in the total contemporaneous emissions changes.

[c] A Pollution Control Project (PCP) exclusion was granted for this pollutant pursuant to Rule 62-212.400(2)(a)2.b., F.A.C. The total for this pollutant is not included in the total contemporaneous emissions changes.

TABLE 3-4
CONTEMPORANEOUS AND DEBOTTLENECKING EMISSIONS ANALYSIS AND PSD APPLICABILITY
PHASE II, BUCKEYE ENERGY PROJECT, BUCKEYE FLORIDA

Source Description	EU ID	Pollutant Emission Rate (TPY)											
		SO_2	NO_x	CO	PM	PM_{10}	$PM_{2.5}$	VOC	TRS	SAM	Lead	Mercury	Fluoride
PROJECTED ACTUAL EMISSIONS													
No. 2 Recovery Boiler w/ NDCE	006	343.41	318.81	879.78	129.37	92.24	64.42	18.16	14.24	15.27	3.39E-03	1.10E-04	0.024
BL Concentrator for No. 2 Recovery Boiler		15.01	--	--	--	--	--	0.63	0.15	0.67	--	--	--
No. 3 Recovery Boiler w/ NDCE	007	369.76	309.98	828.18	121.65	86.73	60 57	14.92	13.82	16.44	3.22E-03	1.24E-04	0.031
BL Concentrator for No. 3 Recovery Boiler		15.62	--	--	--	--	--	0.66	0.15	0.69	--	--	--
BL Storage Tank		--	--	--	--	--	--	0.48	0.79	--	--	--	--
No. 1 Power Boiler	002	839.08	322.58	91.61	63.31	55.17	37.73	6.00	--	37.30	4.59E-03	4.95E-04	0.105
No. 2 Power Boiler	003	0.65	305.37	91.61	8.29	8.29	8.29	6.00	--	--	5.45E-04	2.84E-04	--
No. 1 Bark Boiler	004	145.55	242.20	647.57	146.83	143.89	143.89	36.70	--	6.47	4.32E-02	7.34E-04	0.016
No. 2 Bark Boiler	019	183.94	523.76	1,413.54	390.93	383.11	383.11	80.10	--	8.18	9.42E-02	1.60E-03	0.019
Bark Handling System [a]		--	--	--	3.68	0.88	0.88	--	--	--	--	--	--
Total- Future Potential		1,913.01	2,022.70	3,952.30	864.06	770.31	698.90	163.65	29.15	85.03	1.49E-01	3.35E-03	0.196
BASELINE ACTUAL EMISSIONS													
No. 2 Recovery Boiler w/ DCE	006	613.59	245.03	243.63	73.61	56.52	33.58	41.98	16.71	27.00	4.93E-03	7.88E-05	0.024
BLO System for No. 2 Recovery Boiler		--	--	--	0.98	0.98	0.98	23.91	18.42	--	--	--	--
No. 3 Recovery Boiler w/ DCE	007	544.46	207.42	195.75	33.84	25.98	20.35	33.67	12.13	23.96	4.11E-03	8.19E-05	0.031
BLO System for No. 3 Recovery Boiler		--	--	--	0.80	0.80	0.78	19.16	15.04	--	--	--	--
No. 1 Power Boiler	002	585.88	107.09	14.38	41.48	35.69	18.81	0.86	--	25.78	2.69E-03	2.52E-04	0.075
No. 2 Power Boiler	003	0.07	33.43	9.23	0.91	0.91	0.84	0.60	--	--	5.49E-05	3.10E-05	--
No. 1 Bark Boiler	004	63.94	205.06	547.15	129.94	127.35	127.84	31.00	--	2 81	3.68E-02	6.23E-04	0.009
No. 2 Bark Boiler	019	70.09	455.61	1,226 69	345.96	339.04	346.93	69.51	--	1.75	8.20E-02	1.40E-03	0.012
Total- BASELINE ACTUAL		1,878.03	1,253.65	2,236.84	627.52	587.27	550.10	220.69	62.30	81.30	1.31E-01	2.47E-03	0.152
Increase Due to Project		34.98	769.05	1,715.46	236.54	183.04	148.80	-57.04	-33.15	3.73	1.86E-02	8.81E-04	0.043
PSD SIGNIFICANT EMISSION RATE		40	40	100	25	15	NA	40	10	7	0.6	0.1	3 0
Netting Triggered?		No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No
CONTEMPORANEOUS EMISSION CHANGES													
Tall Oil as Fuel: 1230001-017-AC (2/16/05)		-- [b]	--	--	--	--	-- [b]	-- [b]	-- [b]	-- [b]	-- [b]	-- [b]	-- [b]
No 1 Power Boiler NCG/TRS Destruction 1230001-018-AC (2/16/05)		124.1 [b,c]	--	--	--	--	-- [b]	-- [b]	-48.9 [b]	7.6 [b,c]	-- [b]	-- [b]	-- [b]
No. 2 Brown Stock Washer MACT I Compliance 1230001-014-AC (Completed early 2006)		200.5 [b,c]	198.6 [c]	623.8 [c]	567.2 [c]	468.7 [c]	-- [b]	-55.9 [b]	-46.1 [b]	10.6 [b,c]	5.2E-03 [b]	2.4E-03 [b]	-- [b]
Total Contemporaneous Emission Changes		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL NET CHANGE		34.98	769.05	1,715.46	236.54	183.04	148.80	-57.04	-33.15	3.73	1.86E-02	8.81E-04	0.043
PSD SIGNIFICANT EMISSION RATE		40	40	100	25	15	NA	40	10	7	0.6	0.1	3.0
PSD REVIEW TRIGGERED?		No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No

[a] This emissions unit is not affected during Phase I of the Buckeye Energy Project, and so the projected actual emissions are equal to the baseline actual emissions.

[b] Project does not result in a significant emissions increase for this pollutant. Therfore, netting is not triggered for this pollutant. This pollutant is not included in the total contemporaneous emissions changes.

[c] A Pollution Control Project (PCP) exclusion was granted for this pollutant pursuant to Rule 62-212.400(2)(a)2.b., F.A.C. These emissions are therefore not included in the total contemporaneous emission changes.

ATTACHMENT D

NCASI REFERENCE DOCUMENT EXCERPTS

ncasi technical bulletin

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., 260 MADISON AVENUE, NEW YORK, N.Y. 10016

A STUDY OF PARTICULATE SIZE DISTRIBUTION IN EMISSIONS FROM CONTROLLED SOURCES IN THE KRAFT PROCESS

ATMOSPHERIC QUALITY IMPROVEMENT
TECHNICAL BULLETIN No. 94
MAY 1978

findings from individual company research projects, information generated by consultants and unpublished research conducted by outside organizations not specifically funded by a mill or company.

The third source of data, which enabled filling of information gaps, was developed by NCASI conducted sampling at selected or representative mills meeting current kraft mill emission standards.

A. Uncontrolled Kraft Recovery Furnace Emissions

More particle size sampling has been conducted on kraft recovery furnace emissions than possibly any other kraft mill source. Paul (47) reported results from a non-DCE kraft recovery furnace installation which indicated the uncontrolled particulate concentration level to be approximately 2.75 grains per DSCF during the interval of the particle sizing tests. This value is somewhat lower than the average value of 5.11 grains per DSCF with a range of 3.2 to 10.2 grains per DSCF noted in a survey by Henderson (48) on non-DCE kraft recovery boilers. The most probable reason for low levels of particulate concentration reported based on cascade impactor results is the occurrence of nozzle and wall losses in conjunction with particle bounce. The high concentrations encountered before control devices adversely affect impactor particle collection efficiencies and necessitate shorter sampling times due to overloading of the collection plates. A short sampling interval would decrease the probability of obtaining a representative sample. The particle size distribution relationship suggested by the data presented by Paul (47) is depicted in Figure 6 and represents the average of four sampling tests. The mass mean diameter, Dp_{50}, (the intercept of the curve with the 50% probability level) was found to correspond to 1.6 microns. The geometric standard deviation or polydispersity factor (a completely monodisperse aerosol would have a factor of 1.0 and would appear as a horizontal line on a log probability chart) was calculated to be 2.7 and the gas stream sampled was judged to be a relatively monodisperse particle population.

The bulk density of the dry particulate matter was given (47) as 5 to 10 lb/ft^3 (80 to 160 kg/m^3) which is much lower than the direct contact evaporator (DCE) kraft recovery furnace density values of 20 to 30 lb/ft^3 (320 to 480 kg/m^3). This in itself points to a substantial difference that is possible in particle characteristics. The difference should be kept in mind when attempting to relate particle size distributions for non-DCE and DCE kraft recovery furnace emissions.

Bosch, *et al.*, (49) and Pilat, *et al.*, (9) discussed results of the particle size analysis for emissions representative of an uncontrolled DCE kraft recovery furnace as measured using a University of Washington Mark I cascade impactor. The two distribution curves obtained are depicted in Figure 7. Several characteristics of these relationships are of interest. The mass mean diameter for the two tests averaged 1.0 μm. The polydispersity factor was a quite low 2.6 and approaching a monodisperse aerosol. Bosch, *et al.*,

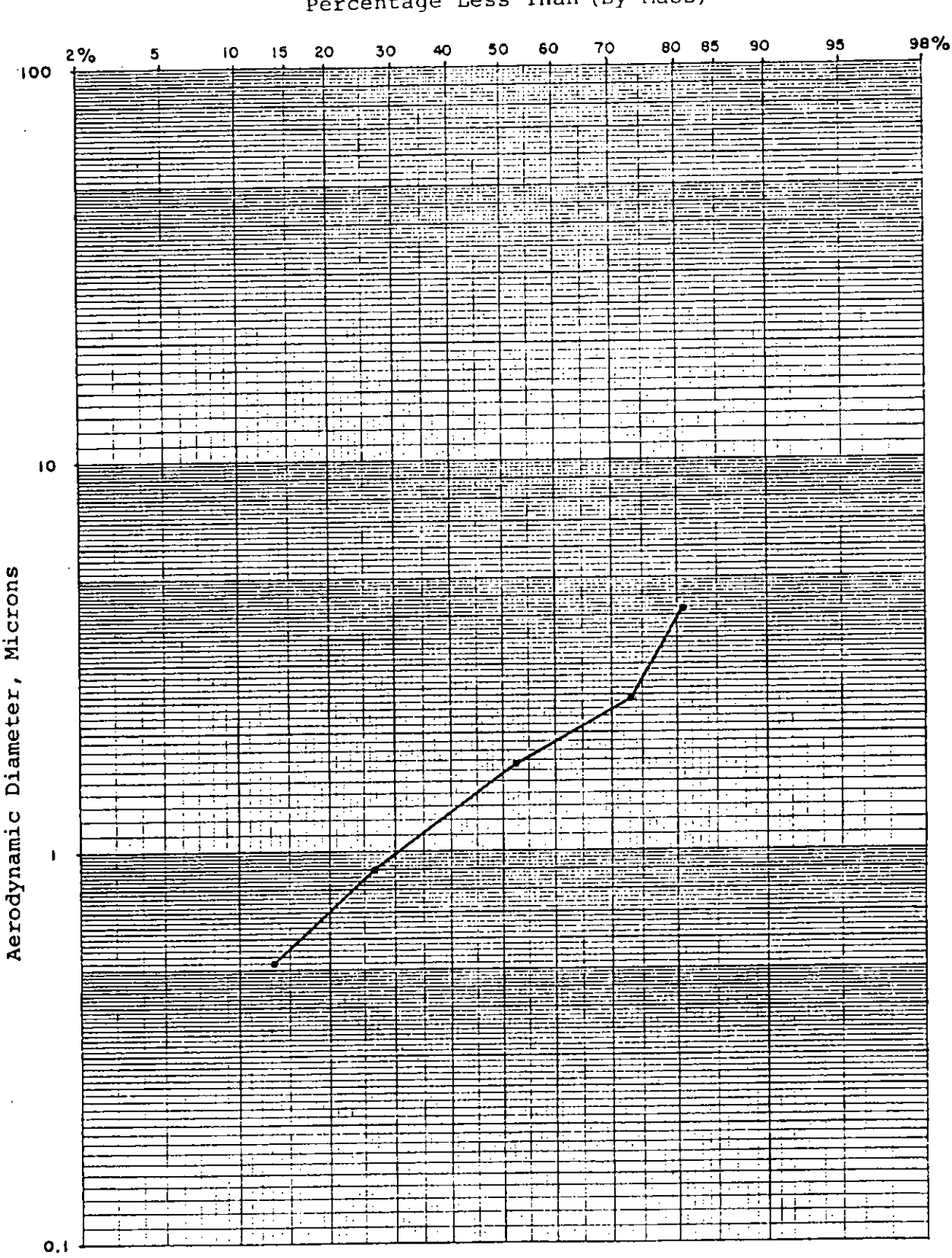

FIGURE 6

"TYPICAL" UNCONTROLLED PARTICLE SIZE DISTRIBUTION FOR NON-DCE KRAFT RECOVERY FURNACE (47)

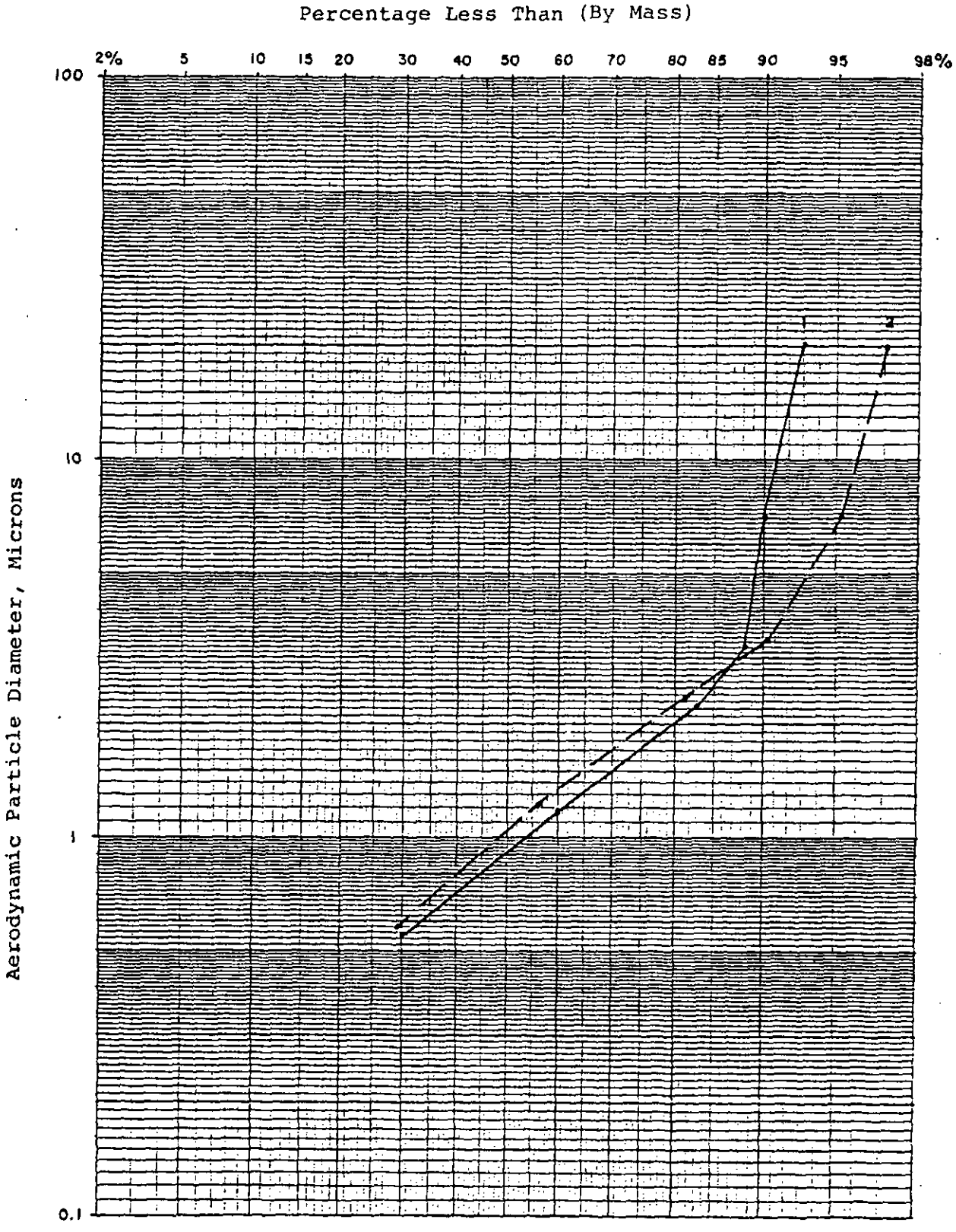

FIGURE 7

UNCONTROLLED DCE KRAFT RECOVERY FURNACE PARTICLE SIZE DISTRIBUTIONS (49) (9)

(49) indicated the presence of a black ash in the two samples obtained. Subsequent analysis showed the occurrence of a high predominance of carbonaceous black ash particles being much larger in overall size than the sodium-salt particles present. Visual inspection of the sample collected on impaction plates indicated two quite different particle populations existed in the recovery furnace exhaust. The non-linearity of Figure 7 was judged to be caused by multiple particle systems, each with a different size distribution with two populations identified as black ash and sodium salt. Separation of the uncontrolled emission samples qualitatively into ash and sodium salt fractions indicated the ash to have a mass mean diameter of roughly 30 μm and the sodium salt with a mass mean diameter of 0.9 μm. The sodium salt fraction of the emissions were found to be approximately 10% of the total particulate weight collected and was actually judged to be relatively independent of particle size. Both resulting distributions were extremely linear in nature suggesting the presence of just the two particle populations noted.

Collins, *et al.*, (50) extensively studied the composition and physical characteristics of kraft recovery furnace fume. He suggests that the fume content is largely composed of sodium sulfate (85%) and sodium carbonate with lesser quantities of sodium chloride, sodium sulfite and black ash. Inherent differences in volatilization temperatures of the various sodium salts, plus the entrainment of smelt particles and ignited black liquor droplets can result in overall changes in the sodium sulfate content. Furnace conditions will also play a major role in the sodium sulfate levels encountered with significant variation possible (51).

The work of Collins, *et al.*, (50) was substantiated by subsequent routine analysis performed by an NCASI member mill (52) on non-DCE kraft recovery furnace particulate emissions caught with a filter using EPA Method 5 procedures. Particulate concentration levels of about 3 pounds per ton of pulp were found to contain usually 80%, with occasionally up to 90%, of the total being sodium sulfate.

Larssen, *et al.*, (53) conducted numerous tests on the DCE kraft recovery furnace previously sampled by Bosch *et al.*, (49) using a University of Washington Mark I cascade impactor. Figure 8 represents the average of two of these tests at a particulate concentration measured at 2.2 grains per DSCF. The non-linearity indicative of multiple particle systems seen in previous size distributions was also apparent here. The mass mean diameter was approximately 0.8 microns associated with a geometric standard deviation of 2.4 which is basically representative of the lower straight portion of the graph as shown. The particle size calculations performed to construct Figure 8 assumed a constant aerodynamic particle density of 1.0 gram per cubic centimeter for all particle sizes.

Kutyna (54) measured the average uncontrolled emission for a Southeast United States DCE kraft recovery furnace using a Brink

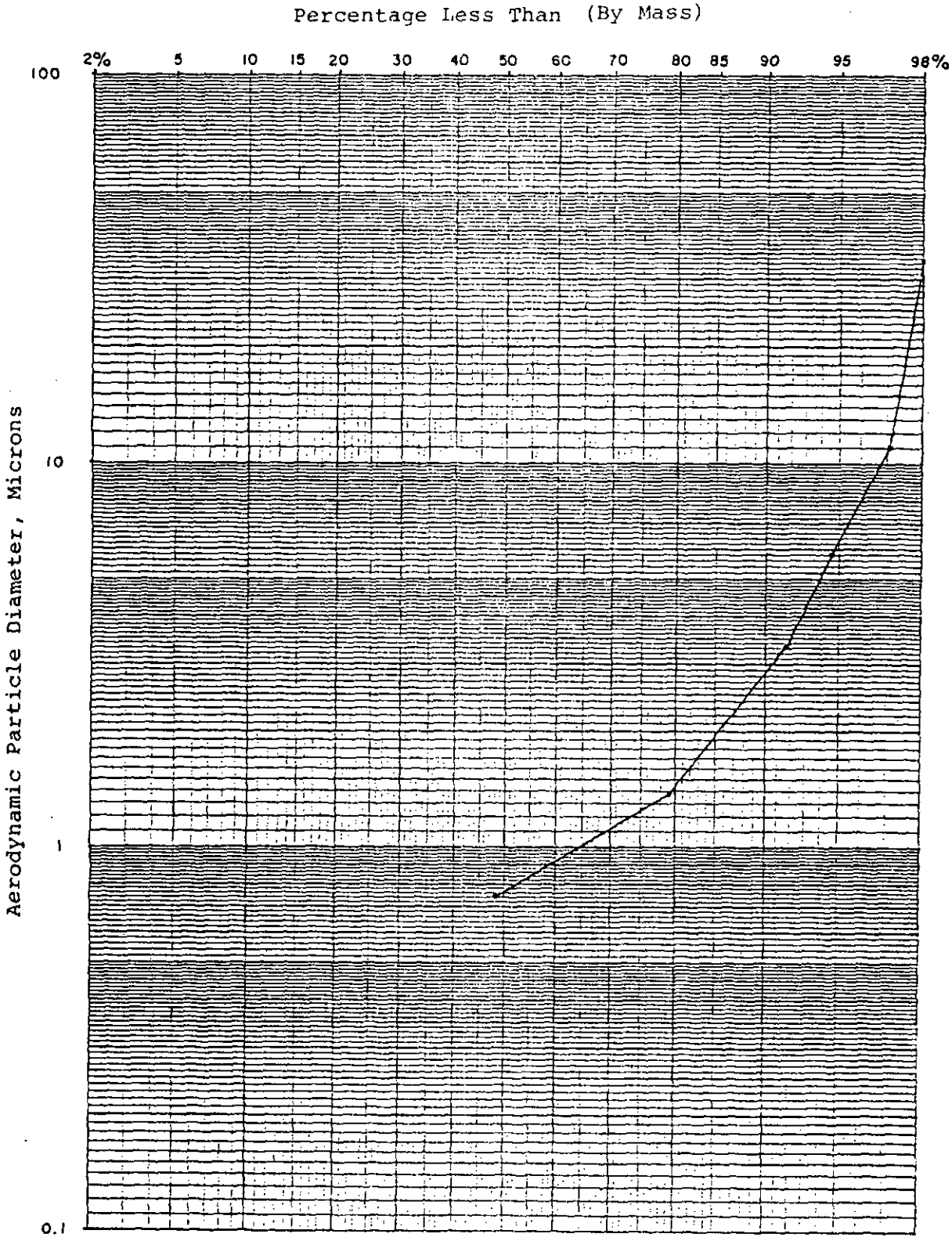

FIGURE 8

UNCONTROLLED PARTICLE SIZE DISTRIBUTION FOR NON-DCE KRAFT RECOVERY FURNACE (53)

cascade impactor equipped with an in-line cyclone. The result as depicted in Figure 9 approximated linearity with a mass mean of 1.3 microns and a geometric standard deviation of 2. The reported electrostatic precipitator inlet particulate concentration was 2.44 grains per DSCF. The use of small nozzles and the cyclone pre-cutter was judged to have caused a slightly lower percentage of large particles and an estimated particulate concentration one-half that possible through use of larger nozzles. The cyclone pre-cutter used was found through calibration to be 50% efficient for particle diameters of 12.5 μm and 10% efficient for 5 μm particles.

B. Controlled Kraft Recovery Furnace Emissions

The size data corresponding to controlled kraft recovery furnace particulate emissions corresponded in all cases to installations equipped with electrostatic precipitators (ESP) and operating at an emission rate of less than 4 pounds per ton during the sampling interval.

A DCE kraft recovery furnace equipped with a two chamber, four field ESP (two, two field ESP's in series) was sampled with a modified Brink cascade impactor by Kutyna (54). The ESP outlet tests conducted were averaged with the mean dust concentration calculated to be 0.053 grains per DSCF. The result of averaging the outlet particle size distributions which were obtained through impactor sampling is shown as Figure 10. The mass mean diameter was determined to be roughly 7.3 microns with a corresponding geometric standard deviation of a somewhat high 8.2. Kutyna (54) suggested that ESP removal efficiencies for the larger particles was poor. He speculated, as did others (48,55), that the large particle fraction is formed during "rapping" of the last ESP field and resulting reentrainment. Gas stream bypass through the ESP was also proposed as a reason for the relative abundance of the larger particles. The use of grease on the collection plates of the impactor was judged to be another reason for the high mass mean diameter which resulted from the testing. Volatilization and scouring of grease would predominate on the lower impactor stage having the higher sampling gas velocities causing a shift of the particle size distribution relationship upward. This would result in a higher overall mass mean diameter based upon the weight loss from just the lower stages of the cascade impactor.

Particle size data obtained from studies by an NCASI member mill (56) for sampling accomplished with a University of Washington Mark III cascade impactor is presented in Figure 11. The unit sampled was a non-DCE kraft recovery furnace equipped with an electrostatic precipitator rated at a 99.8% efficiency. The total exhaust gas flow being treated corresponded to approximately 65% of the rated ESP capacity at the time of sampling. The particulate concentraton was reported as less than 0.01 grains per DCSF. The existence of multiple particle populations was quite evident from the non-linearity of the distributions illustrated in the figure. Contributions from two recovery furnace sources operating

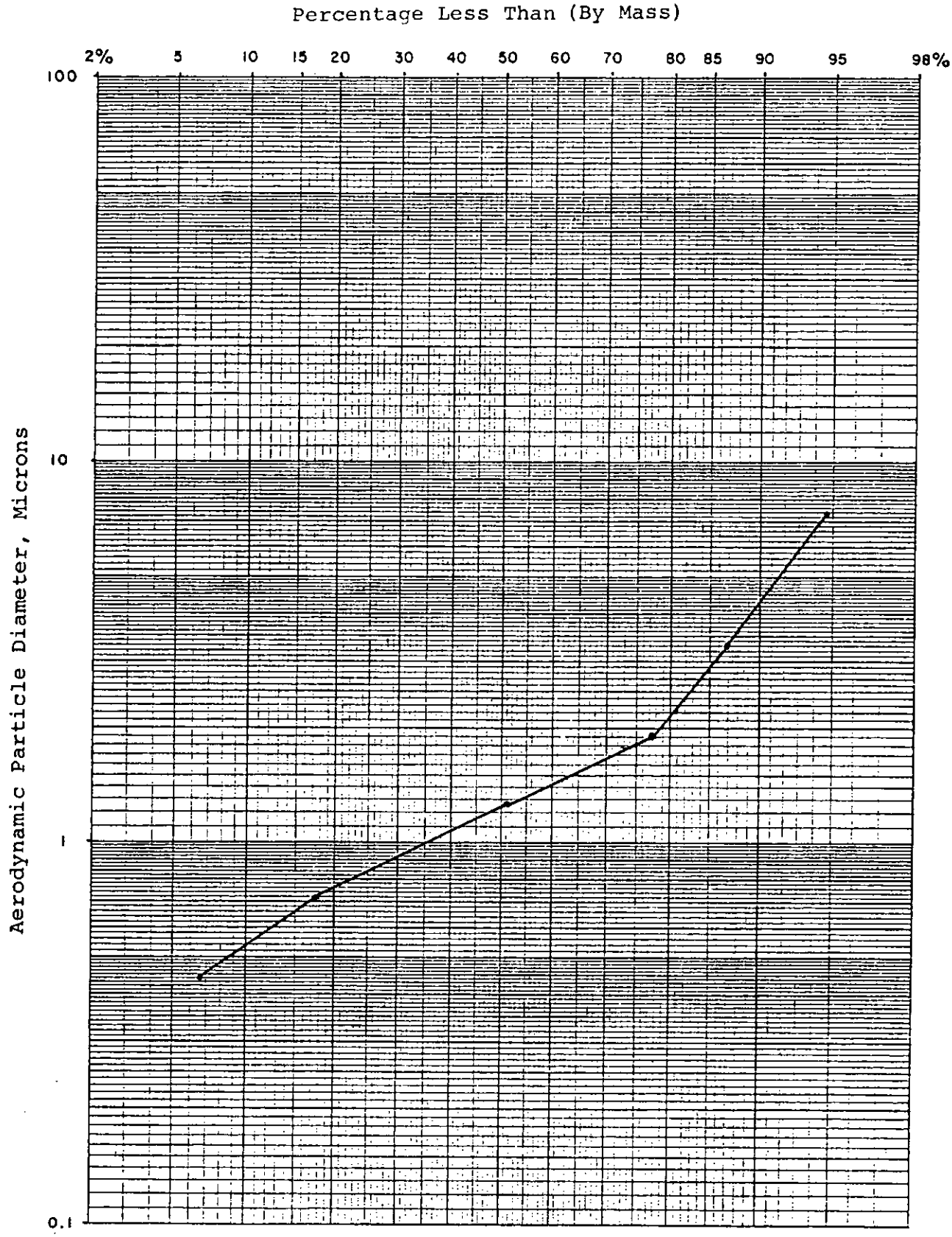

FIGURE 9

UNCONTROLLED PARTICLE SIZE DISTRIBUTION FOR DCE KRAFT RECOVERY FURNACES (54)

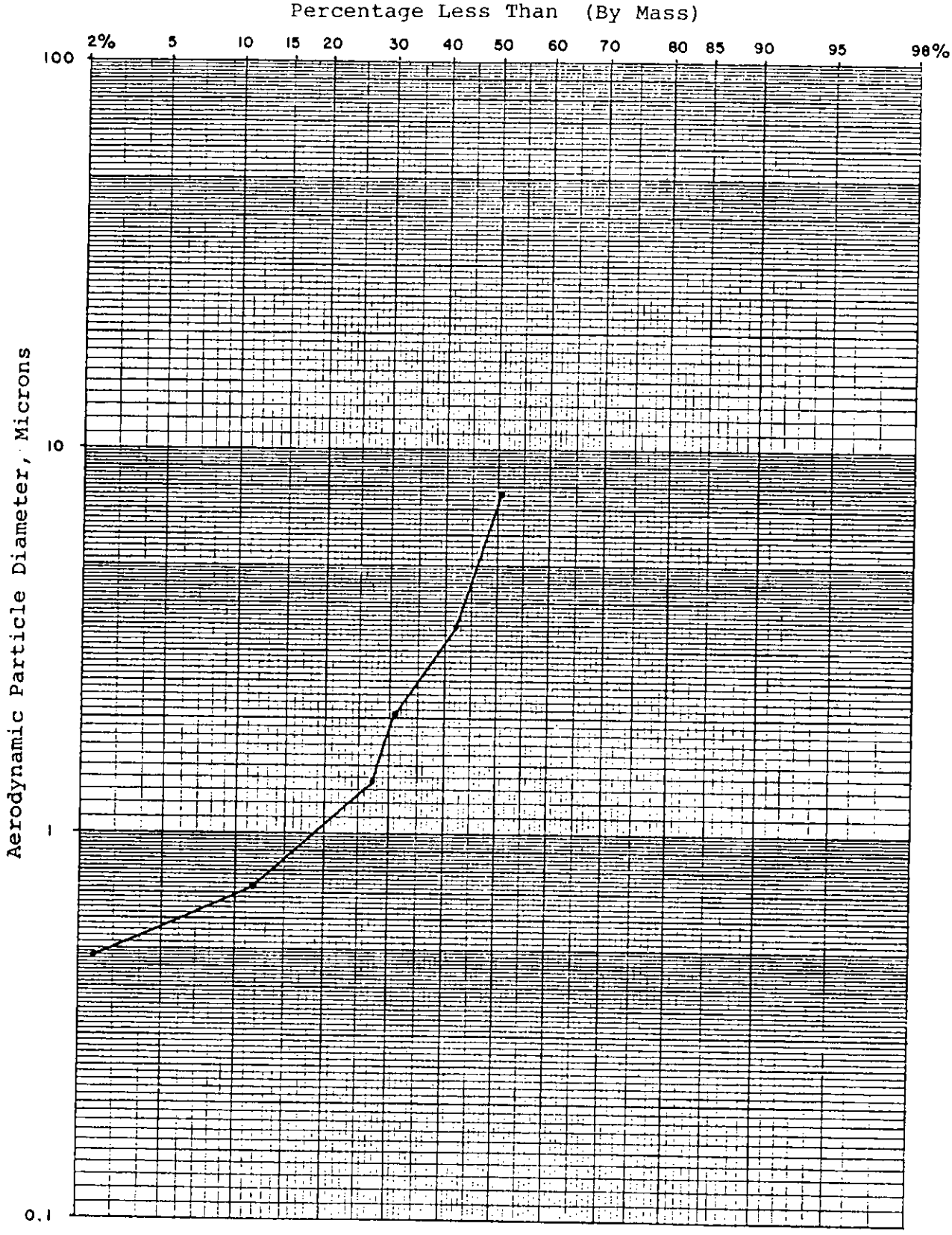

FIGURE 10

OUTLET PARTICLE SIZE DISTRIBUTION FOR DCE KRAFT RECOVERY FURNACE EQUIPPED WITH FOUR FIELD ELECTROSTATIC PRECIPITATOR (54)

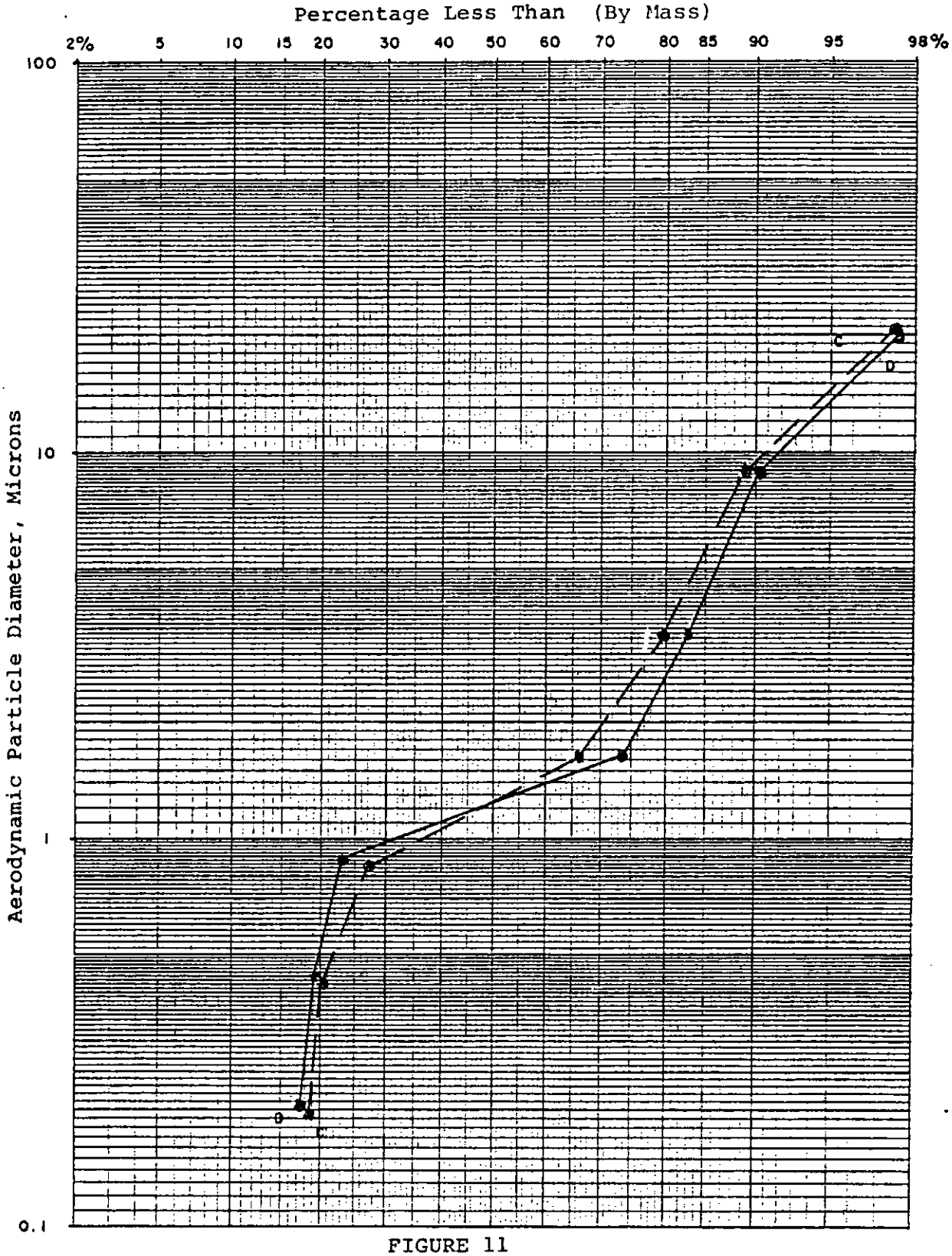

FIGURE 11

OUTLET PARTICLE SIZE DISTRIBUTION FOR NON-DCE KRAFT RECOVERY FURNACE EQUIPPED WITH TWO CHAMBER, FOUR FIELD ELECTROSTATIC PRECIPITATOR (56)

at different control conditions to the total exhaust gas flow is the probable cause of the nonuniform nature of the distribution. Two sampling tests were completed giving an average mass mean diameter of 1.3 microns and a geometric standard deviation of roughly 6.5, indicating a somewhat polydisperse aerosol. The close proximity of the two distribution curves favorably addresses the reproducibility of the impactor sampling method for the testing at this site.

An NCASI member mill provided the following sampling data (57) for use in this summary as compiled by a University of Washington testing group. The Mark III impactor was utilized to conduct seven particle sizing tests over a ten day period on a non-DCE kraft recovery furnace which will be denoted as Site One for further reference. The results of these tests are presented in Figure 12. The furnace and two chamber four field electrostatic precipitator operating conditions were relatively steady during the time interval of the study as reflected by the grouping of the particle distributions. Table 4 presents the mass mean diameter, the geometric standard deviation and selected points from the size distribution for each test. The selected points (80% and 20% less than levels) indicate a scatter in the data with a range for the "80% less than" point of 3.9 to 48.0 microns. Averaging the values presented in the table resulted in 80% of the particle mass being less than 24.3 microns and 20% less than 0.6 microns. The mass mean diameter average corresponds to 50% of the particle mass less than 2.0 microns. Particulate concentration as measured by the Mark III impactor assembly varied from 0.002 to 0.032 with an average of 0.014 grains per DSCF.

NCASI conducted kraft recovery furnace particle size work was accomplished at three sites using a University of Washington Mark III cascade impactor. The sampling was done at three non-DCE electrostatic equipped kraft recovery furnaces. One installation designated as Site One was operating at less than 0.01 grains per DSCF, another (Site Two) at 0.04 grains per DSCF while the third (Site Three) represents a combined stack system (i.e. recovery furnace, lime kilns, smelt tank vent, and power boilers) operating at 0.07 grains per DSCF during the sampling interval.

The non-DCE kraft recovery furnace equipped with a four field ESP and operated at an emission concentration of less than 0.01 grains per DSCF during testing will be discussed first. Two impactor tests (58) were made at the designated Site One, which corresponds to the mill source discussed above and previously referenced (57). The predominance of the fine particle fraction is evident from Figure 13. The distributions obtained displayed a change from testing carried out three years before. Reasons for the shift to finer particles were not readily apparent from discussions with mill personnel. The primary modification to the system during this interval of time was the application of increased insulation to minimize heat losses prior to exit of recovery furnace exhaust gases from the stack. Stack gas temperature increased

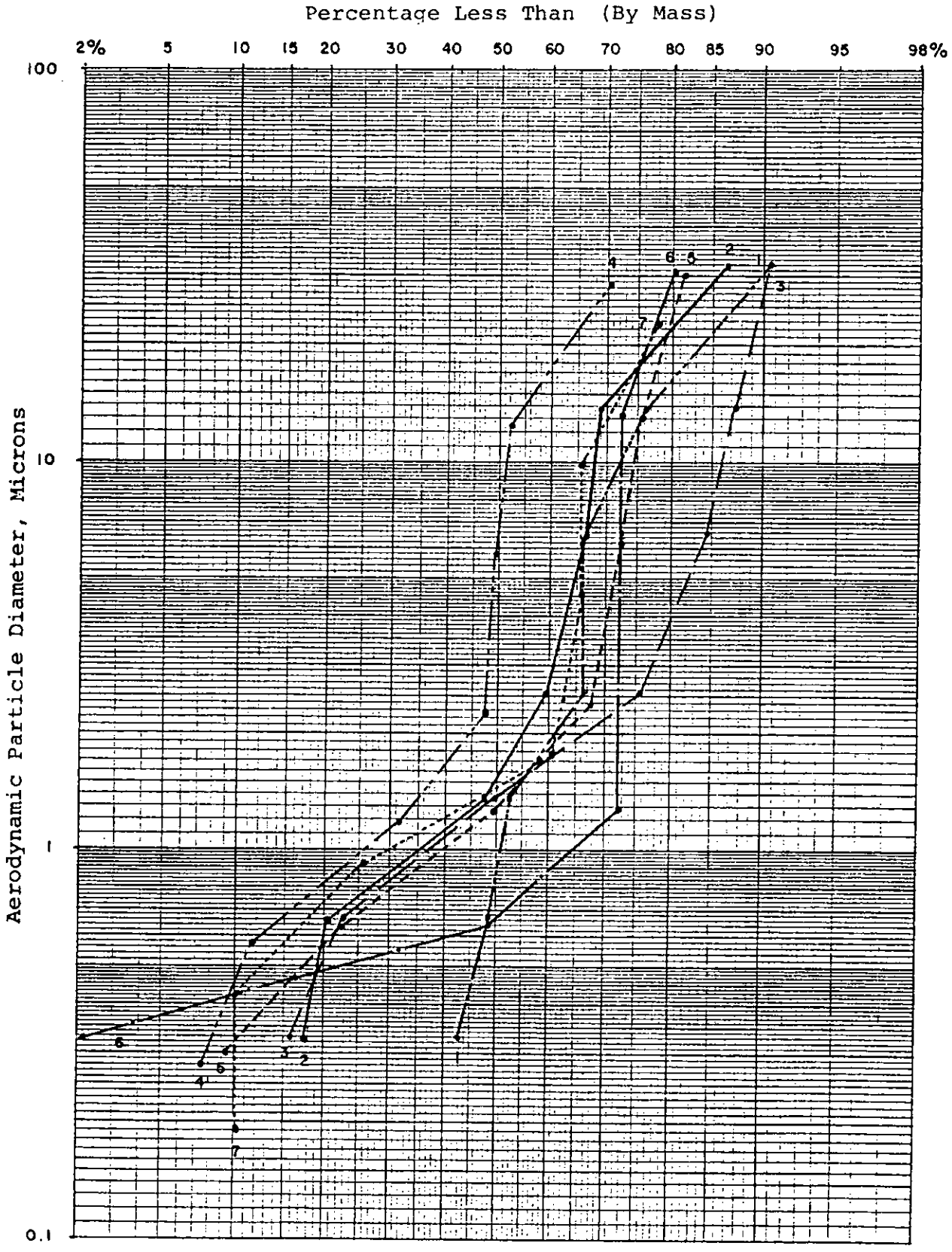

FIGURE 12

OUTLET PARTICLE SIZE DISTRIBUTIONS FOR NON-DCE KRAFT RECOVERY FURNACE, SITE ONE, EQUIPPED WITH TWO CHAMBER, FOUR FIELD ELECTROSTATIC PRECIPITATOR (57)

TABLE 4 PERTINENT PARTICLE SIZE PARAMETERS FOR FIGURE 12

Test Number	1	2	3	4	5	6	7	Average
Mass Mean Diameter, μm (Dp_{50})	0.8	1.6	1.4	7.0	1.3	0.7	1.5	2.0
Geometric Standard Deviation (σg)	24.1	17.7	4.3	10.1	9.9	10.3	7.7	12.0
Selected Points:								
Dp_{80} (μm)	16.5	22.0	3.9	48.0	23.5	30.0	26.0	24.3
Dp_{20} (μm)	-	0.6	0.5	0.8	0.6	0.5	0.7	0.6
Particulate Concentration grains/DSCF	0.002	0.006	0.029	0.03	0.021	0.004	0.006	0.014

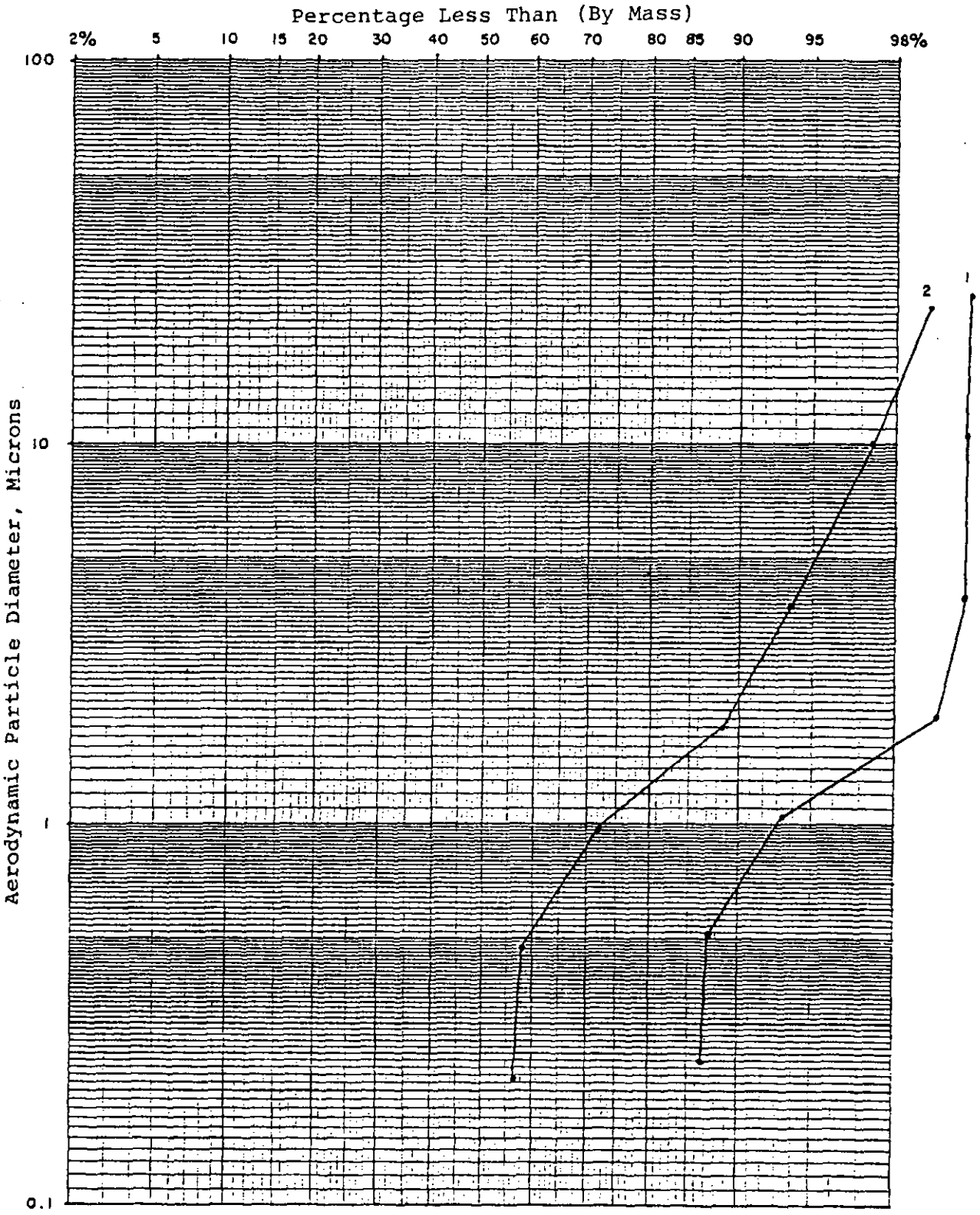

FIGURE 13

NCASI CONDUCTED PARTICLE SIZE DISTRIBUTIONS FOR NON-DCE KRAFT RECOVERY FURNACE, SITE ONE, EQUIPPED WITH TWO CHAMBER, FOUR FIELD ELECTROSTATIC PRECIPITATOR (58)

from approximately 340°F (57) to a current level of about 390°F, supposedly based on this change alone. No change in stack gas moisture was noted.

Comparison of Figures 12 and 13 shows the shift which had occurred at Site One. The average mass mean diameter (Dp_{50}) noted in Table 4 of 2.0 microns corresponds to a Dp_{50} of less than 0.2 microns in the latest testing. The use of the University of Washington Mark III cascade impactor to obtain what might be termed complete size distribution curves for this source was questioned and may be beyond the capabilities of the measurement equipment. The requirement of a sampling interval of four hours at a flow rate of over 1 acfm to collect a representative impactor sample was reasoned to be an untenable procedure for such low total mass of fine particles. The particulate concentration for the two tests (58) averaged a low 0.002 grains per DSCF for these tests as compared to the higher level of 0.014 grains per DSCF for the previous testing.

The estimated geometric standard deviation (σg) for test "2" shown in Figure 13 was calculated to be 10.4. Roughly 90% of the particle mass was found to be less than 2.2 microns for the second sample while the first test measured 90% of the particle mass to be less than 0.7 microns. Table 4 further indicated the change in particle characteristics from the seven tests previously conducted with 80% of the particle mass being less than 24.3 microns as compared to Test "2" having 80% less than 1.3 microns. The obvious implication which was drawn from the very low particulate concentration and relatively fine particle distribution from the latest testing (58) was that an insignificant amount of mass of fine particles were produced from Site One during the sampling interval.

The non-DCE kraft recovery furnace source represented as Site Two was equipped with a two chamber, three field electrostatic precipitator at a Northwest U.S. location (59). A total of four University of Washington Mark III impactor tests were undertaken plus one microscopic comparison test. The results of the four impactor tests are depicted in Figure 14. Tests "1-3" were obtained during what may be termed normal operating conditions. The fourth test occurred during a time when the mill was experiencing slightly abnormal furnace operation and power regulation difficulties with the last field of the ESP. The greater percentage of large particles (i.e. 1 to 10 microns) reinforced the theory proposed earlier relative to particle reentrainment from the last field of the ESP under such conditions.

Supplementary recovery furnace exhaust gas and particle sizing characteristics are compiled in Table 5. The particle characteristics and the size distribution curves in Figure 14 indicate tests 1, 2 and 3 to be quite similar in every respect including particulate concentration which averaged 0.035 grains per DSCF. The average mass mean diameter and geometric standard

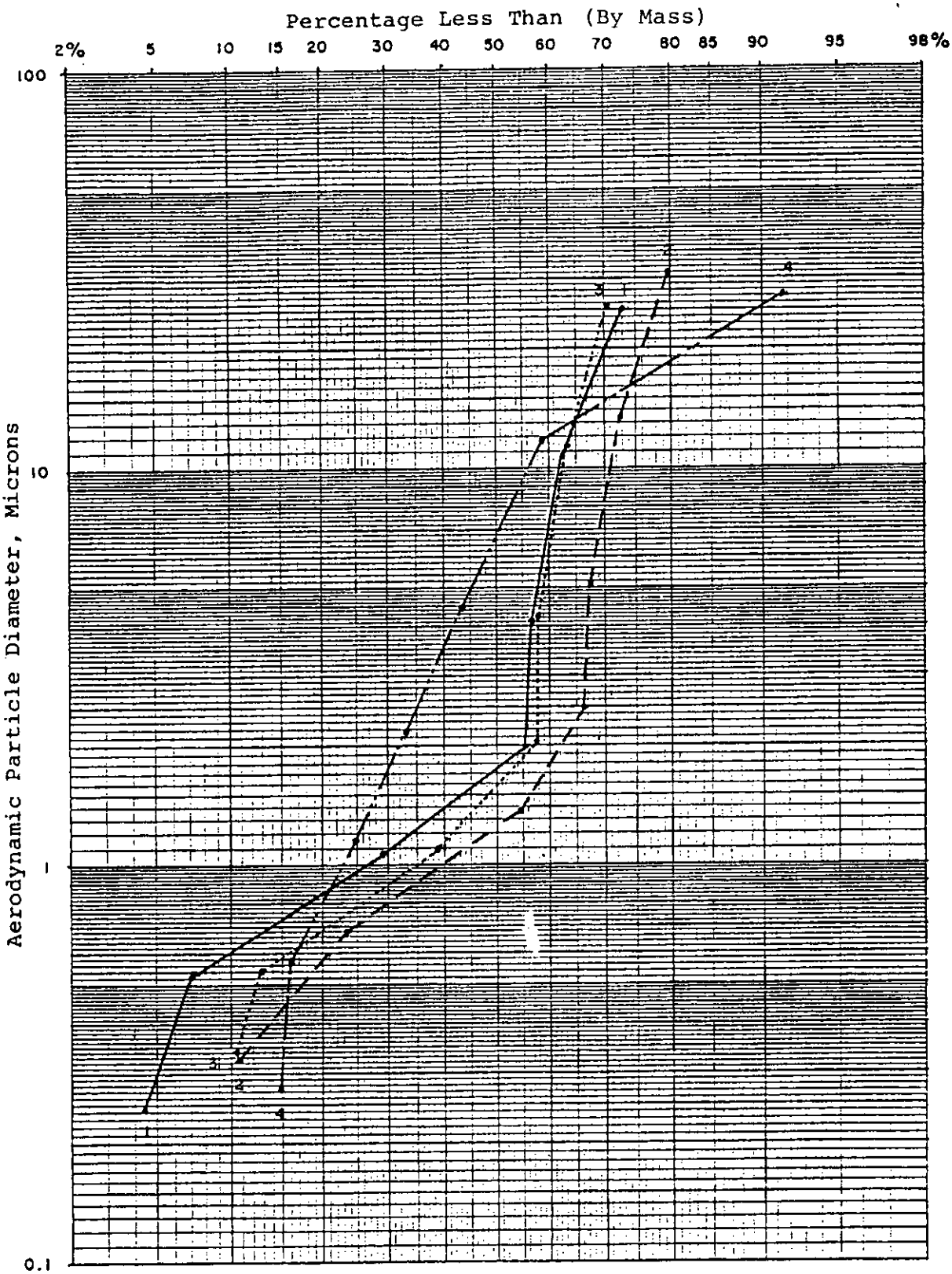

FIGURE 14

NCASI CONDUCTED PARTICLE SIZE DISTIRBUTIONS FOR NON-DCE KRAFT RECOVERY FURNACE, SITE TWO, EQUIPPED WITH TWO CHAMBER, FOUR FIELD ELECTROSTATIC PRECIPITATOR (59)

TABLE 5 NON-DCE KRAFT RECOVERY FURNACE STACK GAS AND PARTICLE SIZING CHARACTERISTICS FOR FIGURE 14

Test	Date	Particulate Concentration (grains/DSCF)	Dp_{50}, µm	Dp_{20}, µm	Dp_{80}, µm	σ_g	Stack Temp. (°F)	Sampling Time Interval, Hours
1	3/10/77	0.040	1.7	0.9	50	8.7	405	0.3
2	3/10/77	0.027	1.2	0.6	32.5	10.5	415	0.4
3	3/31/77	0.039	1.6	0.7	-	11.2	410	0.3
4	11/09/77	0.093	6.8	0.8	18.4	6.1	425	0.3

Dp_{50}: Mass mean particle diameter (at 50% probability)

σ_g: Geometric standard deviation or polydispersity factor

TABLE 6 COMBINED STACK PARTICLE SIZING CHARACTERISTICS FOR FIGURE 15

Test	Date	Particulate Concentration (grains/DSCF)	Dp_{50}, µm	Dp_{20}, µm	Dp_{80}, µm	σ_g	Stack Temp. (°F)	Sampling Time Interval, Hours
1	11/21/77	0.078	1.6	0.6	47.0	10.9	260	0.20
2	11/23/77	0.088	1.8	0.2	23.5	15.4	257	0.23
3	11/23/77	0.060	1.5	0.5	9.4	6.7	258	0.23

deviation for the three tests correspond to 1.5 microns and 10.1. Test 4 reflected the high impactor measured particulate concentration of 0.093 grains per DSCF measured with an equally high mass mean diameter of 6.8 microns. The opportunity was taken during the fourth test to obtain two filter samples suitable for optical microscopic analysis. These results will be presented in a later section.

The Site Three source (60) represents a combined stack system that included exhaust gas from a non-DCE kraft recovery furnace equipped with a two chamber, three field ESP followed by multiclones, two lime kilns equipped with: a common cyclone, venturi scrubber and flooded elbow, one smelt dissolving tank vent equipped with a white liquor scrubbing tank and two oil fired power boilers. A total of three Mark III particle size tests were conducted with the results as presented in Figure 15. Pertinent sizing parameters are given in Table 6. The size distribution curves of the three samples were relatively close and exhibited the non-linearity which usually corresponds to a multiple aerosol particle population. This characteristic was also visually evident from the collection plates. The first three plate inserts had particle deposits which were black in appearance, getting progressively lighter toward the finer particle sizes. Flyash from the uncontrolled power boilers was judged to be responsible for the black constitutent in the larger particle size fractions.

The average particulate concentration, mass mean diameter and geometric standard deviation were in order, 0.075 grains per DSCF, 1.6 microns and 11.0. In addition, 80% of the particle mass averaged less than about 26 microns with 20% less than approximately 0.4 microns.

C. Uncontrolled Lime Kiln Emissions

The next subject area which will be discussed concerns the uncontrolled particle properties of lime kiln emissions. The results of an extensive study to obtain data for the design of control facilities to reduce particulate emissions to compliance levels was carried out by NCASI member mill's technical departments (61) and made available for use in this report. Figure 16 displays particle size distributions for five samples obtained from a lime kiln with the mud feed on and the water spray that is located in the breeching before the venturi scrubber control device turned off. Tests 1, 2, 4, and 5 were conducted with a University of Washington Mark I impactor, while Test 3 incorporated a Mark III cascade impactor. The curves in Figure 16 indicate good consistency in the data that was compiled during a one day interval. Table 7 offers some additional testing parameters. The average particulate concentration was 11.0 grains per DSCF with 20% of the particle mass found to average less than 16.5 microns. The data suggested a majority of large particles. Chemical analysis performed on the samples indicated about 10% of the total catch was a sodium salt or derivative with most of the total quantity occupying the smallest

ncasi technical bulletin

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., 260 MADISON AVENUE, NEW YORK, N.Y. 10016

CARBON MONOXIDE EMISSIONS FROM SELECTED COMBUSTION SOURCES BASED ON SHORT-TERM MONITORING RECORDS

TECHNICAL BULLETIN NO. 416

JANUARY 1984

range corresponded to about 3.0 to 5.0 percent oxygen on a wet gas basis as measured by an in situ oxygen meter. Too little excess air results in carbon monoxide generation because of incomplete combustion, whereas too much excess air reduces combustion zone flame temperature and gas residence time. Either a lack or abundance of oxygen in the flue gas resulted in increased carbon monoxide emission rates.

Figure 10 also shows the effect of auxiliary fuel firing on carbon monoxide emissions. Increased use of auxiliary fuel generally reduced carbon monoxide emission rates. Firing with oil in amounts greater than 50 percent the total energy input resulted in carbon monoxide emissions of less than 0.07 lb/10^6 Btu heat input for this boiler.

C. Carbon Monoxide Emissions from Kraft Recovery Furnaces

Presented in Table 5 are the average carbon monoxide emissions from each recovery furnace over the study period. These values are averages of between 88 and 168 hours of data for each furnace. Also presented in Table 5 are the medians of the 1 hr and 8 hr average emissions for each of the five recovery furnaces studied. Also listed in the table are the average oxygen concentrations measured on a wet basis in the exit gas from each recovery furnace. The average of all carbon monoxide emissions for each furnace ranged from 0.14 to 13.3 lb CO/10^3 lb bls fired, or from 0.43 to about 42 lb carbon monoxide per air dry ton (ADT) unbleached pulp produced. Medians of the 1 hr and 8 hr average data were less than the average data. This was a result of the exponential to logarithmic distribution of the data as illustrated by frequency distribution plots presented in Figures 13 to 17. In these figures the 1 hr and 8 hr average data plotted on Weibull frequency distribution paper show a variability in carbon monoxide emissions of up to two orders of magnitude for each of the recovery furnace studied. For the majority of the time, emissions were in the lower part of the range, but at less frequent intervals relatively high carbon monoxide emission rates were recorded. The level of 8 hr average carbon monoxide emission rates that were exceeded at least 1 percent of the time for furnaces A through E respectively were 0.8, 2.1, 1.3, 11, and 30 lb CO/10^3 lb bls.

A relationship between carbon monoxide emissions and exit gas oxygen concentrations was indicated. Figures 18 to 20 illustrate that at oxygen contents of less than 2 or 3 percent on a wet basis in the furnace exit gas, carbon monoxide emission rates increased rapidly. Similar figures are not shown for furnaces A and C because flue gas oxygen concentrations at these furnaces showed little variation during this study and no relationship to carbon monoxide emissions existed. The recovery furnace with emissions greater than 10 lb CO/10^3 lb bls was generally operating with less than 3 percent oxygen in the furnace exit gas. Recovery furnaces are normally operated at low excess combustion air to aid in reduction of sodium sulfate to sodium sulfide in the smelt.

TABLE 5 CARBON MONOXIDE EMISSION MEASURED AT FIVE KRAFT RECOVERY FURNACES

Furnace	Hours of Data	Total Average lb $CO/10^3$ lb bls	Total Average lb CO/ADT	Median of 1-hr Average CO Emissions	Median of 8-hr Average CO Emissions	Average O_2
A	88	0.14	0.43	0.06	0.08	3.8
B	120	0.60	1.8	0.33	0.48	3.3
C	136	0.64	3.1	0.56	0.60	3.2
D	168	1.87	5.9	0.95	0.96	3.1
E	152	13.3	42	12.2	12.5	2.8

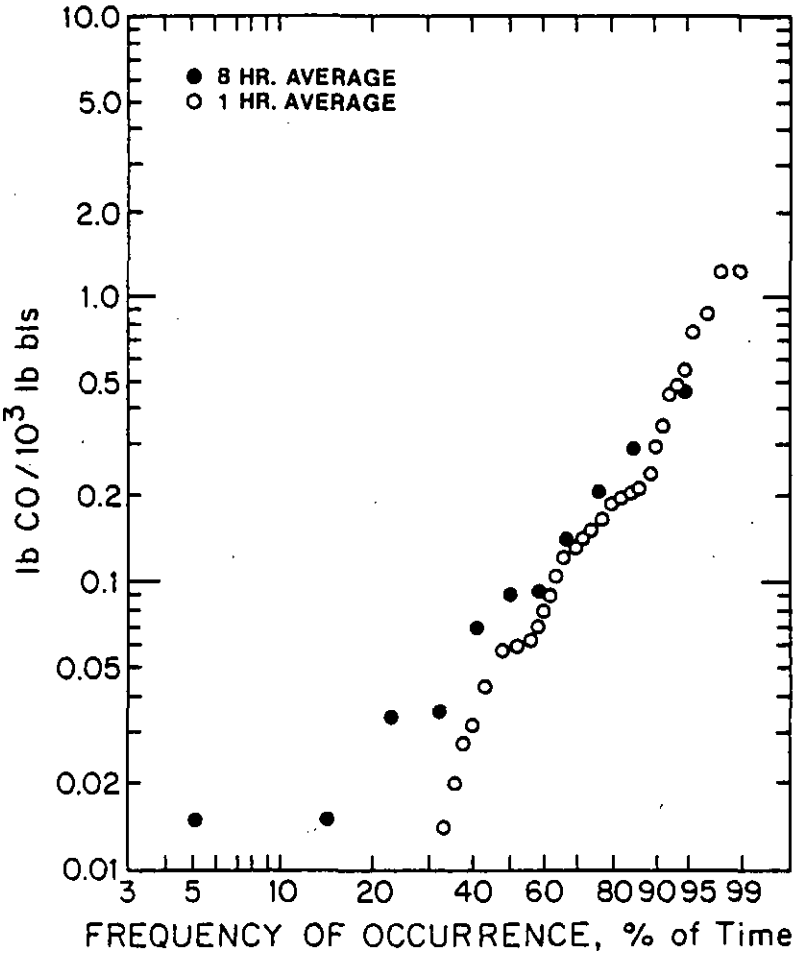

FIGURE 13

FREQUENCY OF CARBON MONOXIDE EMISSIONS FROM KRAFT RECOVERY FURNACE A

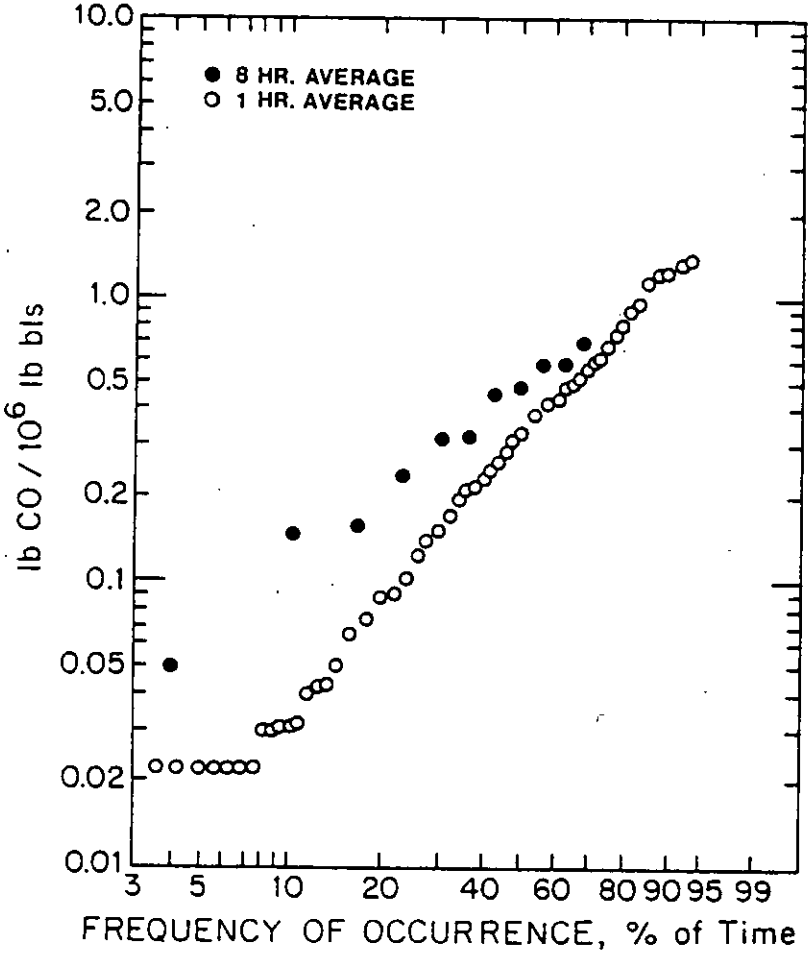

FIGURE 14

FREQUENCY OF CARBON MONOXIDE EMISSIONS FROM KRAFT RECOVERY FURNACE B

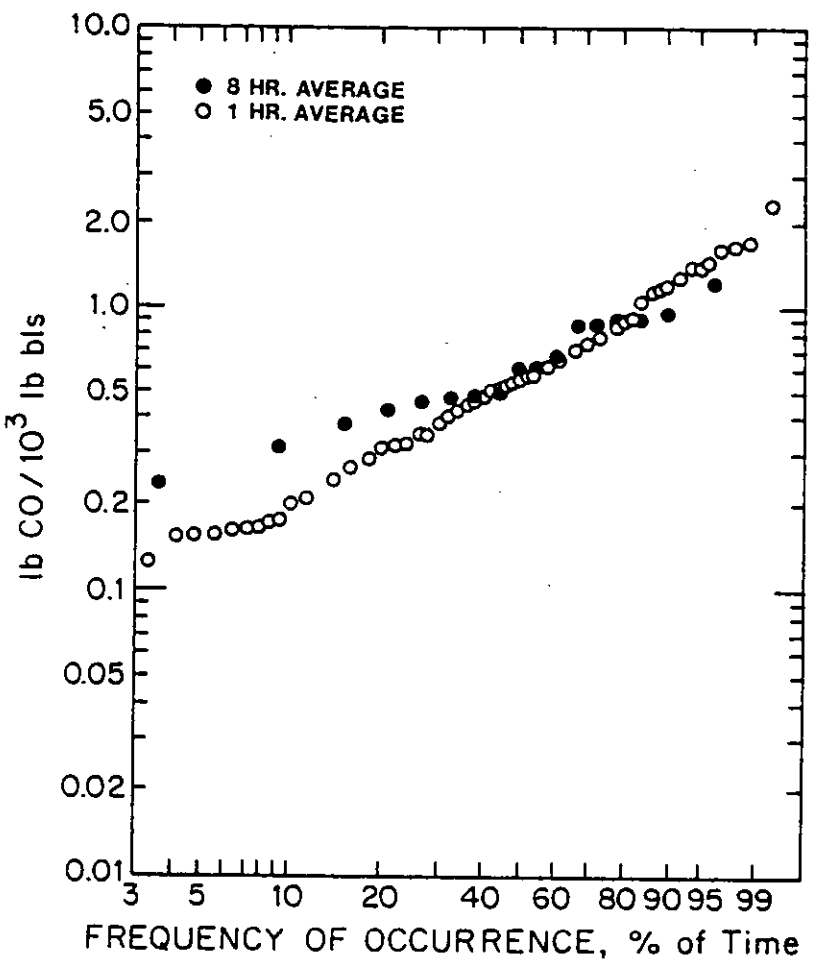

FIGURE 15

FREQUENCY OF CARBON MONOXIDE EMISSIONS FROM KRAFT RECOVERY FURNACE C

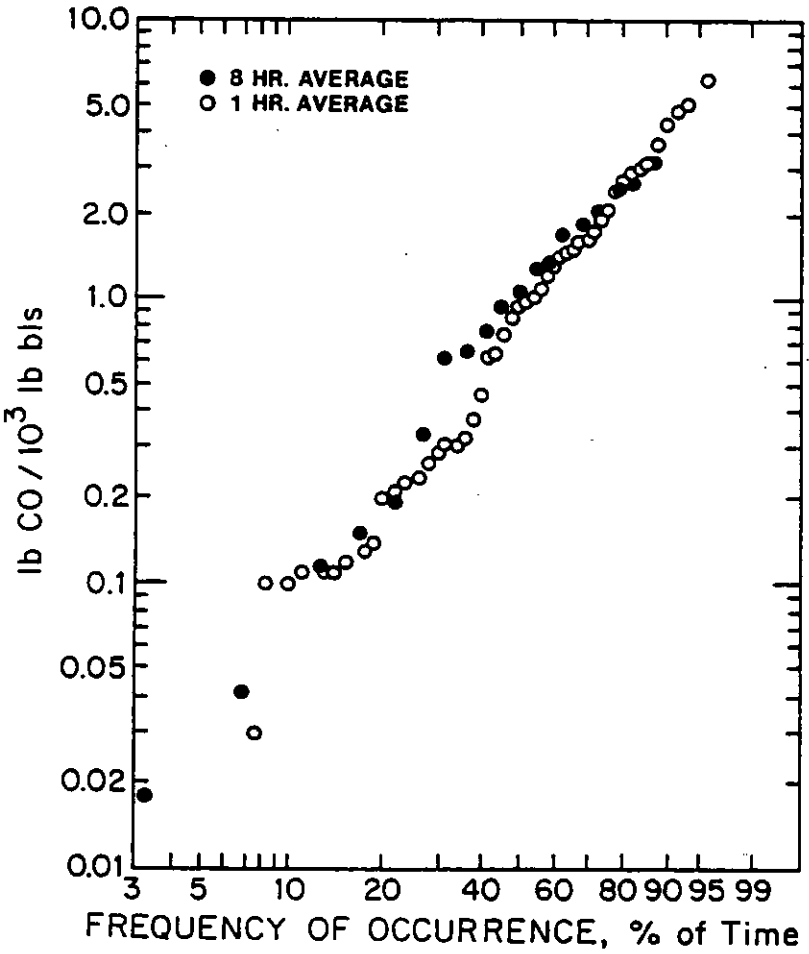

FIGURE 16

FREQUENCY OF CARBON
MONOIXDE EMISSIONS
FROM KRAFT RECOVERY FURNACE D

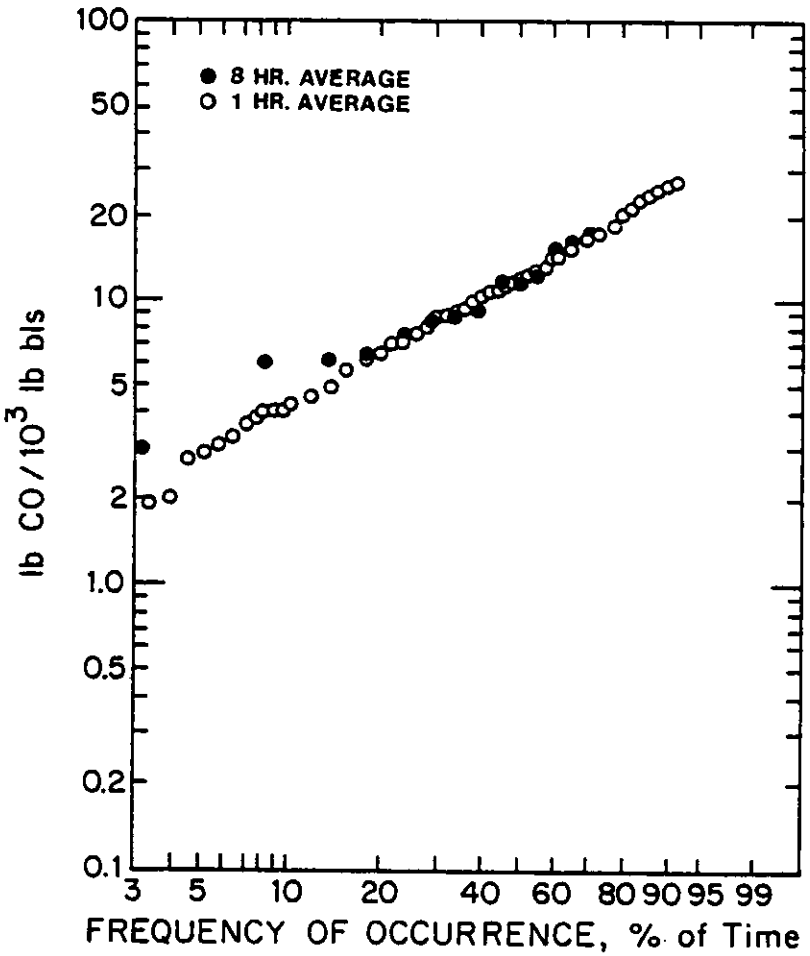

FIGURE 17

FREQUENCY OF CARBON
MONOXIDE EMISSIONS
FROM KRAFT RECOVERY FURNACE E

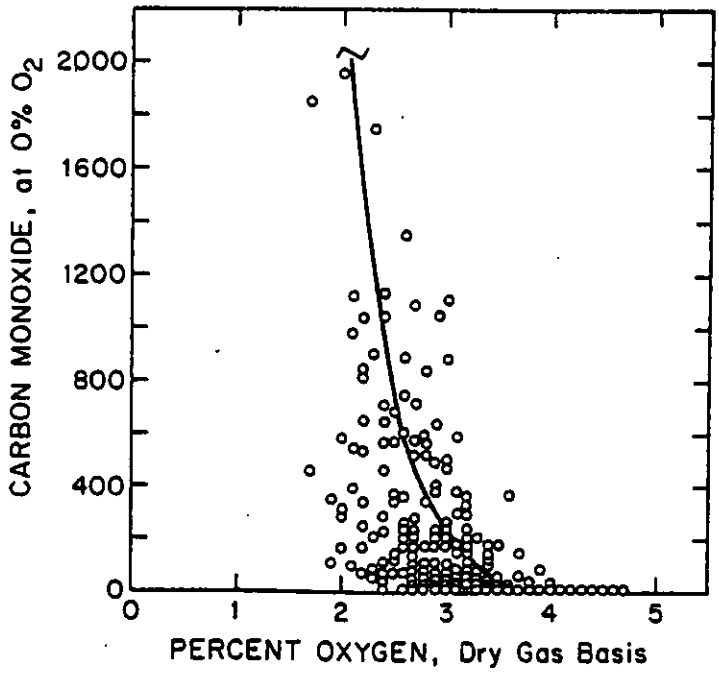

FIGURE 18

CARBON MONOXIDE EMISSIONS FROM KRAFT RECOVERY FURNACE B EXPRESSED AS ppm CORRECTED TO 0 PERCENT O_2 AS A FUNCTION OF STACK GAS OXYGEN CONCENTRATIONS

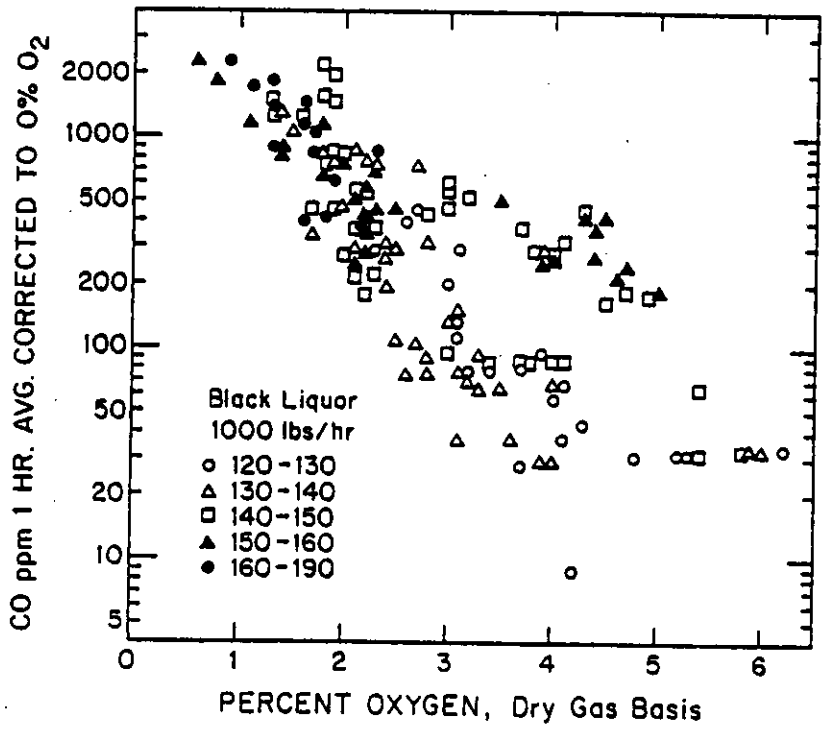

FIGURE 19

CARBON MONOXIDE EMISSIONS FROM KRAFT RECOVERY FURNACE D EXPRESSED AS ppm CORRECTED TO 0 PERCENT O_2 AS A FUNCTION OF STACK GAS OXYGEN CONCENTRATION

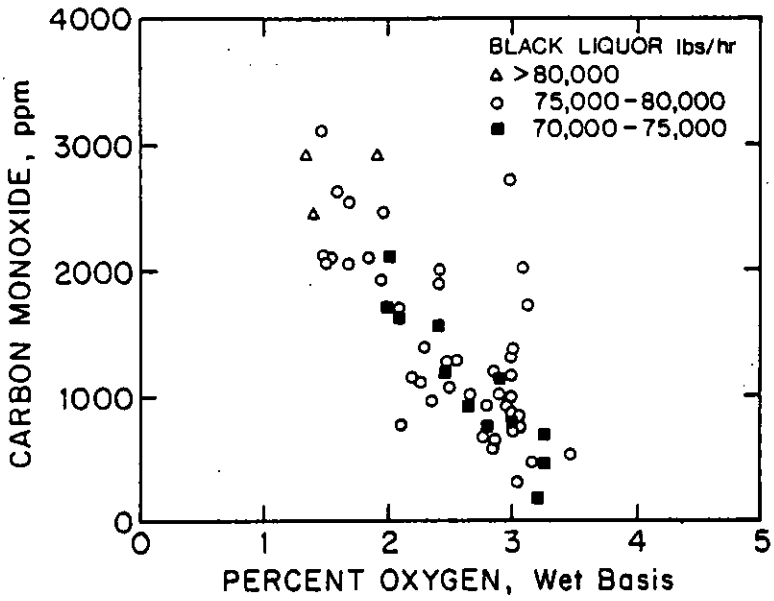

FIGURE 20

CARBON MONOXIDE EMISSIONS FROM KRAFT RECOVERY FURNACE E EXPRESSED AS ppm CORRECTED TO 0 PERCENT O_2 AS A FUNCTION OF STACK GAS OXYGEN CONCENTRATION

D. Relationship Between Carbon Monoxide and TRS Emissions from Kraft Recovery Furnaces

Total Reduced Sulfur (TRS) emission data was collected from the recovery furnaces along with the carbon monoxide emission data to look for possible correlation between the two. Both TRS emissions and carbon monoxide emissions for the two DCE equipped recovery furnaces, A and C were low and no relationship could be found. Recognizing the TRS-CO emission relationships on DCE furnaces are tenous because of TRS contributions of the DCE, TRS emissions from this type of kraft recovery furnace tended to increase when carbon monoxide emissions increased above some level. This is illustrated in Figures 21 to 23 where the percent of time the TRS concentration in the exit gas exceeded 5 ppm was plotted as a function of the carbon monoxide concentration for DCE furnaces. These diagrams show that the probability of exceeding a 5 ppm TRS concentration increased with higher carbon monoxide emission levels. If appears unlikely that the increase in TRS emissions, as carbon monoxide increased, would be attributable to the TRS contribution from the contact evaporator. The TRS-carbon monoxide relationship for each DCE recovery furnace was found to be different. In only one case, however, were TRS emissions sufficiently low (Recovery Furnace C) to indicate a critical level of carbon monoxide where TRS emissions started to

ncasi special report

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., 260 MADISON AVENUE, NEW YORK, N.Y. 10016

ESTIMATES OF 1990 SULFUR DIOXIDE AND OXIDES OF NITROGEN EMISSIONS FROM PULP AND PAPER MILLS

SPECIAL REPORT 93 - 03
FEBRUARY 1993

E. Lime Kilns

Lime kiln SO_2 and NO_x emissions were calculated based on reported 1990 equivalent pulp production (or lime production) and an emission factor of 0.06 lb/ADTP for SO_2 and 0.6 lb/ADTP for NO_x (6), unless monitoring or emissions test data were available. As noted in reference 6, average emissions do not appear to depend on the type of fossil fuel burned or whether non-condensible gases (NCGs) are combusted in the kiln.

F. TRS Incineration

SO_2 emissions from the burning of NCGs in a stand-alone incinerator were calculated from reported (a) measured SO_2 emissions in lb/ADTP, (b) kraft pulp production, and (c) hours of operation of the incinerator for 1990. If measurements were not reported, an average emission factor of 8 lb SO_2/ADTP was used. If a scrubber SO_2 removal efficiency was reported, SO_2 emissions were reduced accordingly. NO_x emissions were assumed to be insignificant.

If NCGs were reported as being burned in a boiler, a factor of 8 lb SO_2/ADTP and total kraft pulp production were used to estimate the additional uncontrolled emissions. If the boiler was equipped with an SO_2 removal system, emissions were reduced by the reported average 1990 removal efficiency. If the boiler was only used as a back-up combustion device, it was assumed that NCGs were routed to the boiler 2% of the time.

G. Sulfite Mills

Most sulfite mills reported annual SO_2 emissions from the pulp mill and any chemical recovery operations based on measurements or monitoring results. If a mill did not report any measurements or monitoring information, the average emission factor for the reporting mills (10.7 lb SO_2/ADTP) and the reported 1990 pulp production were used to estimate SO_2 emissions.

Similarly, NO_x emissions were based on reported monitoring or measurement data. In the absence of data, an emission factor for ammonia-based mills with recovery furnaces of 9.2 lb/ADTP and for magnesium-based mills with recovery furnaces of 2.1 lb/ADTP and reported annual pulp production were used to estimate NO_x emissions.

H. Stand-Alone Semi-Chemical Mills

Very little data are available for these mills. SO_2 emissions from pulping and liquor burning operations at sulfur-based semi-chemical mills were computed with an emission factor

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NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., 260 MADISON AVENUE, NEW YORK, N.Y. 10016

COMPILATION OF 'AIR TOXIC' EMISSION DATA FOR BOILERS, PULP MILLS, AND BLEACH PLANTS

TECHNICAL BULLETIN NO. 650

JUNE 1993

B. Oil-Fired Boilers

Table 4A provides uncontrolled emission factors for oil combustion for eleven trace metals, POM and formaldehyde for both residual and distillate grade oil firing. These factors are reproduced from Table 4.3.3-3B of the current draft update to the AP-42 document on fuel oil combustion (2). Just as for coal, sulfuric acid emissions from oil combustion are related to the oil sulfur content, and these are not shown here.

The emissions of trace metals from oil-fired boilers would be affected by the control device that follows the boiler (except perhaps Hg and Se which remain mostly in the vapor phase). However, no data on control removal efficiencies of the various metals are available at the present time. Removal efficiencies of POM, HCHO, Se and Hg may be assumed to be zero for reasons given earlier for coal combustion.

Table 4B provides emission data for 11 trace metals, benzene, formaldehyde, total polycyclic aromatic hydrocarbons (PAHs), and several PAH species for residual fuel oil combustion. These data were obtained from stack tests conducted on several utility boilers during the California Utility Boiler Study (5). Speciated PAH emissions data for industrial boilers are unavailable at the present time. It should be noted for the data in Table 4B, the percentage of samples that was below the method detection limit was quite high for a number of compounds. In particular, all tests for benzene gave non-detectable concentrations. The rules for treatment of non-detected data in this report, which were outlined in section III, may be used here. Fuel metal analyses were also carried out during the Utility Boiler Study (5). Based on the study results, the authors cautioned that prediction of metal emissions from fuel analyses may significantly over- or underestimate actual emissions (5).

C. Gas-Fired Boilers

Table 4C provides emission data for benzene, formaldehyde, total PAHs and speciated PAHs corresponding to natural gas combustion in utility boiler stacks (5). Non-criteria pollutant emission data corresponding to industrial boilers were not available in the latest update to section to 1.4 of the AP-42 document (3). Once again, concentrations of several compounds as shown in Table 4C were below their method detection limits and tests for benzene always yielded non-detectable concentrations.

D. Wood-Fired Boilers

Table 5A lists organic compound emissions data corresponding to 20 wood-fired boilers. Based on available information, only wood residue was fired in these boilers during the tests. Emissions from four boilers in which wastewater treatment sludge was also fired in separate tests are described

in the next section. The units described in Table 5A range in size from 6000 lb steam/hr to about 650,000 lb steam/hr, and include fuel cells, Dutch ovens, stokers and fluidized beds. Boilers with mill codes WFB16a, WFB17, WFB18a, WFB19a and WFB20a correspond to wood-fired boilers situated at kraft pulp mills, while the remaining 15 boilers (all in California) correspond to relatively smaller steam or electric power generating facilities burning bark, sawdust and wood shavings (6,7).

A total of 49 different organic compounds, several of which are not on the 1990 CAAA list of 189 HAPs, are listed in Table 5A. Test methods used are identified in the table when such information was available. The emissions are expressed in both concentration units (ppb or ppm @ 12 percent CO_2) and in units of lb/10^6 Btu (lb/MM Btu). For conversion to units of lb/ton of dry wood residue, a nominal conversion factor of 18 x 10^6 Btu/ton dry wood residue may be used. Concentrations below detection limits are treated as described in section III.

Small amounts of organic compounds are emitted from virtually all combustion sources. As with CO emissions, the rate at which these products of incomplete combustion (PICs) are emitted depends on the combustion efficiency of the boiler. The burning of auxiliary fossil fuel such as natural gas or fuel oil along with wood residue is expected to enhance the combustion efficiency in the boiler, resulting in reduced emissions of PICs. The species of wood residue fired, viz., softwood versus hardwood, is also expected to impact the level of some organic emissions. Formaldehyde emissions, for example, are expected to be higher when firing hardwood residues as opposed to softwood residues. For boilers equipped with a scrubber, an additional factor that may affect the level of organic emissions is the type of scrubbing medium used. The use of fresh water versus pulp mill condensates in the scrubber would be expected to minimize stripping of organic constituents from the scrubbing medium. Finally, the type of control device may also affect the level of emissions of some PICs. For example, water soluble PICs such as methanol would be expected to be partially absorbed across a wet scrubber. Also, semi-volatile PICs that exist partially in the condensed phase in the flue gases are perhaps more efficiently precipitated across ESPs as compared to scrubbers or mechanical control devices such as multiclones.

Table 5B provides trace metal emissions data for 17 wood-fired boilers. It should be noted that the particulate control devices on these boilers varied widely. Boilers with mill codes WA, WN1 and WO1 correspond to wood-fired boilers situated at kraft pulp mills, while boilers with mill codes WB to WL (all in California) correspond to relatively smaller steam or electric power generating facilities burning bark, sawdust and wood shavings (6).

Table 5B includes data for a total of eighteen different trace metals, including hexavalent chromium. Test methods used are identified in the table when such information was available. Emissions are expressed both in units of $lb/10^{12}$ Btu and lb/ton of dry fuel (lb/TDF). Concentrations below detection limits are treated as described in section III.

Emissions from the four boilers equipped with electrostatic precipitators are shown separately from the remaining 13 boilers. Several trace metals selectively adsorb onto the fly ash surface, and thus their removal is dependent on particulate control device efficiencies, especially for submicron-sized particulates. Also, the type of wood residue burned can vary considerably from one mill to another. Residues with higher trace metal contents will naturally have a greater propensity to emit higher concentrations of these trace metals. Trace metal content in the fuel and the control device efficiencies for individual trace metals are key factors in determining trace metal emissions from wood-fired boilers.

E. Wastewater Treatment Sludge Burning in Wood-Fired Boilers

Table 5C provides organic compound emissions data for four boilers which were tested while firing wood residue and also while firing a combination of small quantities (<12 percent heat input) of wastewater treatment sludge and wood residue. All four boilers were situated at pulp mills that produced bleached pulp. In the case of the mill WFB16 boiler, which is equipped with a wet scrubber, these tests were repeated, once using fresh water and once using pulp mill clean condensates as the scrubbing fluid.

Data on emissions of 48 organic compounds when burning wood residue and wood residue in combination with kraft bleached mill sludge in the four wood-fired boilers are provided in Table 5C. A comparison of the emission data for the two fuel types shows no discernible impact on emissions of these organics when the sludge was co-fired with wood residue. Also, although data are restricted to just one boiler, except for emissions of methanol, the impact of using clean pulp mill condensates versus fresh water appears to be minimal.

Table 5D presents the results of tests for metals emissions from two boilers in which wood-waste and a combination of wood-waste and bleach kraft mill sludge were burned. The heat input from sludge during these tests was less than 12 percent. The first boiler was equipped with a scrubber, whereas the second boiler uses an electrostatic precipitator for particulate control. An examination of the results in Table 5D suggests that adding sludge to the wood-waste did not have any discernible impact on trace metals emissions from these boilers.

TABLE 3 EMISSION FACTORS FOR UNCONTROLLED BITUMINOUS COAL-FIRED BOILER COMBUSTION[a] (1)
(All Emission Factors in lb/10^{12} Btu heat input)

Firing Configuration (SCC)	Sb	As	Be	Cd	Cr	Co	Pb	Mn	Hg	Ni	Se	POM	HCOH
Pulverized Coal Configuration Unknown (no SCC)	no data	no data	no data	no data	1822	no data	no data	no data	no data	no data	no data	no data	112 b
Pulverized Coal Wet Bottom (10100201)	no data	538	81	44-70	1020-1570	no data	507 c	808-2980	16	840-1290	no data	no data	no data
Pulverized Coal Dry Bottom (10100202)	no data	884	81	44.4	1250-1570	no data	507 c	228-2980	16	1030-1290	no data	2.08	no data
Pulverized coal Dry Bottom, Tangential (10100212)	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	2.4	no data
Cyclone Furnace (10100203)	no data	115	<81	28	212-1502	no data	507 c	228-1300	16	174-1290	no data	no data	no data
Stoker Configuration Unknown (no SCC)	no data	no data	73	no data	19-300	no data	no data	2170	16	775-1290	no data	no data	no data
Spreader Stoker (10100204)	no data	284-542	no data	21-43	942-1570	no data	507 c	no data	no data	no data	no data	no data	221 d
Traveling Grate, Overfed Stoker (10100205)	no data	542-1030	no data	43-82	no data	no data	507 c	no data	no data	no data	no data	no data	140 e

[a] The emission factors in this table are the ranges of factors evaluated in the literature search. If only one data point was found, it was still reported in this table.
[b] Based on 2 units; 1640 GJ/hr, 140 GJ/hr
[c] Lead emission factors were taken directly from an EPA background document for support of the NAAQS.
[d] Based on 1 unit; 82 GJ/hr
[e] Based on 1 unit; 155 GJ/hr

TABLE 4A EMISSION FACTORS FOR EXTERNAL RESIDUAL AND DISTILLATE OIL COMBUSTION[a] (2)
(All Emission Factors in lb/10^{12} Btu heat input)

Firing Configuration (SCC)	Sb	As	Be	Cd	Cr	Co	Pb	Mn	Hg	Ni	Se	POM	HCOH b
Residual, Grade 6, Normal Firing (10100401)	24-46	19-114	4.2-4.4	16-211	21-128	77-121	28-194	23-74	1.4-32	837-2333	37-39	7.4-8.4c	161-405
Residual, Grade 6, Normal Firing (10100404)	24-46	19-114	4.2-4.4	16-211	21-128	77-121	28-194	23-74	1.4-32	837-2333	37-39	7.4-8.4c	161-405
Residual, Grade 6, Normal Firing (10200401)	24-46	19-114	4.2-4.4	16-211	21-128	77-121	28-194	23-74	1.4-32	837-2333	37-39	7.4-8.4c	161-405
Residual, Grade 6, Normal Firing (10300401)	24-46	19-114	4.2-4.4	16-211	21-128	77-121	28-194	23-74	1.4-32	837-2333	37-39	7.4-8.4c	161-405
Distillate, Grade 2, (10100501)	no data	4.2	2.5	11	48-67	no data	8.9	14	3.0	170	no data	22d	233-405
Distillate, Grade 2, (10200501)	no data	4.2	2.5	11	48-67	no data	8.9	14	3.0	170	no data	22d	233-405
Distillate, Grade 2, (10300501)	no data	4.2	2.5	11	48-67	no data	8.9	14	3.0	170	no data	22d	233-405

a The emission factors in this table are the ranges of factors evaluated in the literature search. If only one data point was found, it was still reported in this table.
b Based on old and limited data
c Particulate and gaseous POM
d Particulate POM only

TABLE 4B EMISSION DATA FOR UTILITY BOILERS FIRING RESIDUAL FUEL OIL (5)

	lb/MMBtu (Range)	% of Samples Below Detection Limit
Benzene	2.27×10^{-6} - 3.00×10^{-6}	100
Formaldehyde	1.10×10^{-5} - 1.65×10^{-4}	47
Arsenic	3.97×10^{-6} - 2.00×10^{-5}	0
Beryllium	4.21×10^{-8} - 2.10×10^{-7}	39
Cadmium	6.72×10^{-7} - 3.04×10^{-5}	0
Chromium VI	4.07×10^{-7} - 4.04×10^{-6}	7
Copper	9.76×10^{-6} - 1.65×10^{-5}	0
Lead	2.51×10^{-6} - 2.20×10^{-5}	0
Manganese	3.90×10^{-6} - 2.60×10^{-5}	0
Mercury	2.00×10^{-6} - 6.15×10^{-5}	100
Nickel	3.00×10^{-4} - 1.06×10^{-3}	0
Selenium	3.40×10^{-6} - 1.14×10^{-5}	22
Zinc	7.01×10^{-5} - 4.50×10^{-4}	0
Total PAH*	5.31×10^{-7} - 5.29×10^{-5}	64
Acenapthene	6.32×10^{-9} - 1.02×10^{-7}	33
Acenaphthylene	6.32×10^{-9} - 9.22×10^{-9}	100
Anthracene	6.32×10^{-9} - 1.43×10^{-8}	39
Benz[a]anthracene	6.40×10^{-10} - 1.02×10^{-7}	83
Benzo[b]fluoranthene	6.40×10^{-9} - 3.65×10^{-8}	89
Benzo[k]fluoranthene	6.40×10^{-9} - 3.65×10^{-8}	89
Benzo[a]pyrene	6.32×10^{-9} - 9.22×10^{-9}	100
Benzo[g,h,i]perylene	6.40×10^{-9} - 6.95×10^{-8}	94
Chrysene	6.40×10^{-9} - 1.75×10^{-8}	83
Dibenzo[a,h]anthracene	6.40×10^{-9} - 2.47×10^{-8}	83
Fluroanthene	6.40×10^{-9} - 2.55×10^{-8}	39
Fluorene	6.40×10^{-9} - 3.15×10^{-8}	39
Indeno[1,2,3,c,d]pyrene	6.40×10^{-9} - 6.25×10^{-8}	83
Napthalene(1)	4.23×10^{-7} - 1.21×10^{-5}	0
Phenanthrene	6.40×10^{-9} - 1.08×10^{-7}	22
Pyrene	6.40×10^{-9} - 3.17×10^{-8}	50

*PAH - Polycyclic Aromatic Hydrocarbons

(1) It should be noted that napthalene is a decomposition product of XAD-2 resin. Although resin modules are stored in ice chests to minimize decomposition, it is still common to see measurable napthalene levels in both PAH samples and in blank samples. It is possible that much of the reported napthalene emissions (after correction for field blank values) are due to resin decomposition and not to unit emissions. CARB is currently evaluating this problem and may remove napthalene from the test method.

TABLE 4C EMISSION DATA FOR UTILITY BOILERS FIRING NATURAL GAS (5)

	lb/MMBtu (Range)	% of Samples Below Detection Limit
Benzene	1.08×10^{-6} - 4.48×10^{-6}	100
Formaldehyde	1.70×10^{-5} - 3.33×10^{-4}	13
Total PAH (1)(2)	4.48×10^{-8}	90
Napthalene(3)	1.99×10^{-8}	0
Acenaphthylene	1.41×10^{-9}	100
Acenaphthene	1.41×10^{-9}	100
Fluorene	2.01×10^{-9}	67
Phenanthrene	3.70×10^{-9}	67
Anthracene	1.57×10^{-9}	100
Fluoranthene	1.41×10^{-9}	100
Pyrene	1.41×10^{-9}	100
Benz[a]anthracene	1.41×10^{-9}	100
Chrysene	1.41×10^{-9}	100
Benzo[b]fluoranthene	1.59×10^{-9}	100
Benzo[k]fluoranthene	1.49×10^{-9}	100
Benzo[a]pyrene	1.65×10^{-9}	100
Indeno[1,2,3,c,d]pyrene	1.49×10^{-9}	100
Dibenzo[a,h]anthracene	1.41×10^{-9}	100
Benzo[g,h,i]perylene	1.53×10^{-9}	100

(1) PAH - Polycyclic Aromatic Hydrocarbons
(2) No range of values is given. This data was obtained from a single-triplicate test series on a 750 MWe, opposed fired boiler (natural gas).
(3) Refer to Note #1, Table 4B

TABLE 5B SUMMARY OF 'AIR TOXIC' TRACE METAL EMISSIONS FROM WOOD-FIRED BOILERS

MILL CODE	FUEL	TEST DATE	SOURCE DESCRIPTION	CONTROL DEVICE	REFERENCE
WA	WD RES	1991	STOKER, 350 KPPH	SCRUBBER	14
WB	WD RES	1990	FUEL CELL, 6 KPPH	CYCLONE	6
WC	WD RES	1990	FUEL CELL, 68 KPPH	MULTICLONE	6
WD	WD RES	1990	DUTCH OVEN, 50 KPPH	MULTICLONE	6
WE	WD RES	1990	DUTCH OVEN, 37 KPPH	WET SCRUBBER	6
WF	WD RES	1990	STOKER, 90 KPPH	WET SCRUBBER	6
WG	WD RES	1990	STOKER, 118 KPPH	WET SCRUBBER	6
WK	WD RES	1990	AIR INJECTED, 43 KPPH	MULTICLONE	6
EPA1	WD RES	NA	NA	NA	20
EPA2	WD RES	NA	NA	NA	20
EPA3	WD RES	NA	NA	NA	20
WN1	WD RES	1992	SPREADER STOKER, 200 KPPH	SCRUBBER	8
WO1	WD RES	1990	SPREADER STOKER, 500 to 550 KPPH	ELECTROSCRUBBER	14
WH	WD RES	1990	STOKER, 136 KPPH	ELECTROSTATIC PRECIPITATOR	6
WI	WD RES	1990	STOKER, 164 KPPH	ELECTROSTATIC PRECIPITATOR	6
WJ	WD RES	1990	STOKER, 167 KPPH	ELECTROSTATIC PRECIPITATOR	6
WL	WD RES	1990	FLUIDIZED BED, 92 KPPH	ELECTROSTATIC PRECIPITATOR	6

References

6. Sassenrath, C.P., "Air Toxic Emissions from Wood-Fired Boilers" 1991 Tappi Environmental Conference Proceedings, San Antonio, pp 483-491.
8. Texas Emissions Speciation Study, Emission Test Results, Roy F. Weston, Inc. January 1993.
14. Individual Mill Testing for 'Air Toxics', NCASI Mill File Information.
20. "Toxic Air Pollutant Emission Factors - A Compilation of Selected Air Toxic Compounds and Sources, Second Edition, EPA-450-2-90-011, October 1990.

TABLE 5B SUMMARY OF 'AIR TOXIC' TRACE METAL EMISSIONS FROM WOOD–FIRED BOILERS, CONTD:

	Antimony, Sb		Arsenic, As		Barium, Ba		Beryllium, Be		Cadmium, Cd		Cobalt, Co	
MILL	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/
CODE	1E+12 Btu	TDF*	1E+12 Btu	TDF	1E+12 Btu	TDF	1E+12 Btu	TDF	1E+12 Btu	TDF	1E+12 Btu	TDF
BOILERS WITHOUT ESPs												
WA					6.7E+00	1.2E–04			4.7E–01	8.5E–06		
WB			1.4E+01	2.5E–04			ND**	ND**	1.7E+00	3.1E–05		
WC			6.6E–01	1.2E–05			ND**	ND**	3.7E+00	6.7E–05		
WD			2.0E+01	3.6E–04			ND**	ND**	5.5E+00	9.8E–05		
WE			6.3E+00	1.1E–04			ND**	ND**	1.7E+00	3.0E–05		
WF			6.6E+00	1.2E–04			ND**	ND**	1.0E+00	1.9E–05		
WG			3.7E+01	6.7E–04			ND**	ND**	5.3E–01	9.5E–06		
WK			8.8E–01	1.6E–05			ND**	ND**	1.8E+00	3.2E–05		
EPA1					2.6E+02	4.6E–03					1.1E+01	2.0E–04
EPA2					3.9E+02	7.0E–03					9.8E–01	1.8E–05
EPA3					4.1E+02	7.4E–03						
WN1			ND [3.7]	ND [6.5E–5	ND [2950]	ND [5.2E–2	ND [3.7]	ND [6.5E–5	ND [3.7]	ND [6.5E–5]		
WO1	ND [140]	ND [2.5E–3	1.4E+00	2.5E–05	4.8E+03	8.7E–02	1.4E+02	2.5E–03			4.2E+02	7.6E–03
AVG	ND [140]	ND [2.5E–3	9.8E+00	1.8E–04	1.2E+03	2.2E–02	1.7E+01	3.1E–04	2.0E+00	3.7E–05	1.5E+02	2.6E–03
MAX			3.7E+01	6.7E–04	4.8E+03	8.7E–02	1.4E+02	2.5E–03	5.5E+00	9.8E–05	4.2E+02	7.6E–03
MIN			ND	ND	ND	ND	ND	ND	ND	ND	9.8E–01	1.8E–05
SOURCES	1		9		6		9		8		3	
BOILERS WITH ESPs												
WH			2.1E–01	3.8E–06			ND**	ND**	3.0E–01	5.5E–06		
WI			4.1E–01	7.3E–06			ND**	ND**	8.4E–01	1.5E–05		
WJ			2.1E–01	3.8E–06			ND**	ND**	2.1E–01	3.8E–06		
WL			2.0E–01	3.6E–06			ND**	ND**	2.6E–01	4.6E–06		
AVG			2.6E–01	4.6E–06			0.0E+00	0.0E+00	4.0E–01	7.2E–06		
MAX			4.1E–01	7.3E–06			0.0E+00	0.0E+00	8.4E–01	1.5E–05		
MIN			2.0E–01	3.6E–06			0.0E+00	0.0E+00	2.1E–01	3.8E–06		
SOURCES			4				4		4			

TEST METHODS – (1) MILLS WB to WL – CARB 436 (CARB 425 for Cr & Cr+6); (2) MILLS WNI & WO1 – EPA DRAFT MULTIPLE METALS;
* TDF – ton of dry wood fuel
** detection limit unknown; assumed zero or lowest detection limit in column for purposes of estimating average

TABLE 5B SUMMARY OF 'AIR TOXIC' EMISSIONS (METALS) FROM WOOD–FIRED BOILERS, CONTD.

	Chromium, Cr		Chromium+6		Copper, Cu		Lead, Pb		Manganese, Mn		Mercury, Hg	
MILL CODE	lb/ 1E+12 Btu	lb/ TDF	lb/ 1E+12 Btu	lb/ TDF	lb/ 1E+12 Btu	lb/ TDF	lb/ 1E+12 Btu	lb/ TDF	lb/ 1E+12 Btu	lb/ TDF	lb/ 1E+12 Btu	lb/ TDF
BOILERS WITHOUT ESPs												
WA	6.6E−01	1.2E−05			1.7E+00	3.1E−05	1.4E+00	2.6E−05	1.1E+01	2.0E−04	6.8E−01	1.2E−05
WB	3.1E+01	5.6E−04	1.6E+02	2.9E−03	1.2E+02	2.1E−03	3.2E+02	5.8E−03	1.1E+03	2.0E−02	0.0E+00	0.0E+00
WC	4.4E+00	7.8E−05	3.3E+00	5.9E−05	3.4E+01	6.1E−04	3.2E+00	5.7E−05	1.6E+03	2.9E−02	2.9E−01	5.2E−06
WD	9.6E+00	1.7E−04	4.8E+00	8.6E−05	1.8E+02	3.2E−03	7.8E+01	1.4E−03	5.3E+03	9.5E−02	2.3E+00	4.2E−05
WE	3.1E+00	5.6E−05	5.3E+00	9.5E−05	3.3E+01	6.0E−04	6.9E+01	1.2E−03	3.8E+02	6.8E−03	0.0E+00	0.0E+00
WF	1.5E+01	2.7E−04	2.0E+00	3.6E−05	1.5E+01	2.6E−04	3.6E+01	6.5E−04	1.0E+02	1.8E−03	4.8E−01	8.7E−06
WG	4.9E+00	8.8E−05	5.0E+00	8.9E−05	3.7E+01	6.6E−04	2.0E+01	3.6E−04	1.3E+02	2.4E−03	8.7E−01	1.6E−05
WK	5.5E+00	9.9E−05	6.4E+00	1.1E−04	2.9E+01	5.3E−04	1.4E+01	2.5E−04	1.4E+03	2.6E−02	0.0E+00	0.0E+00
EPA1	2.1E+01	3.8E−04			4.4E+01	7.9E−04						
EPA2	1.7E+01	3.0E−04			2.2E+01	4.0E−04						
EPA3	1.7E+01	3.0E−04			5.6E+01	1.0E−03						
WN1	6.6E+00	1.2E−04	ND [0.47]	ND [8.3E−6	1.1E+01	1.9E−04	1.2E+01	2.2E−04	2.9E+01	5.1E−04	ND [3.7]	ND [6.6E−5
WO1	1.4E+02	2.5E−03			4.2E+02	7.6E−03	1.4E+02	2.5E−03	1.0E+04	1.9E−01	3.6E+01	6.6E−04
AVG	2.1E+01	3.8E−04	2.3E+01	4.2E−04	7.7E+01	1.4E−03	6.9E+01	1.2E−03	2.0E+03	3.7E−02	4.3E+00	7.7E−05
MAX	1.4E+02	2.5E−03	1.6E+02	2.9E−03	4.2E+02	7.6E−03	3.2E+02	5.8E−03	1.0E+04	1.9E−01	3.6E+01	6.6E−04
MIN	6.6E−01	1.2E−05	0.0E+00	0.0E+00	1.7E+00	3.1E−05	1.4E+00	2.6E−05	1.1E+01	2.0E−04	0.0E+00	0.0E+00
SOURCES	13		8		13		10		10		10	
BOILERS WITH ESPs												
WH	1.3E+00	2.3E−05	3.4E+00	6.1E−05	3.1E+00	5.6E−05	1.6E+00	2.8E−05	9.5E+01	1.7E−03	0.0E+00	0.0E+00
WI	9.1E−01	1.6E−05	1.7E+00	3.0E−05	4.1E+00	7.4E−05	2.7E+00	4.9E−05	5.6E+01	1.0E−03	3.9E−01	6.9E−06
WJ	4.2E−01	7.6E−06	1.0E+00	1.9E−05	1.6E+00	2.9E−05	1.7E+00	3.1E−05	2.3E+01	4.2E−04	2.9E−01	5.2E−06
WL	1.5E+00	2.7E−05	2.3E+00	4.1E−05	4.8E+00	8.7E−05	2.3E+00	4.1E−05	6.5E+01	1.2E−03	0.0E+00	0.0E+00
AVG	1.0E+00	1.8E−05	2.1E+00	3.8E−05	3.4E+00	6.1E−05	2.1E+00	3.7E−05	6.0E+01	1.1E−03	1.7E−01	3.0E−06
MAX	1.5E+00	2.7E−05	3.4E+00	6.1E−05	4.8E+00	8.7E−05	2.7E+00	4.9E−05	9.5E+01	1.7E−03	3.9E−01	6.9E−06
MIN	4.2E−01	7.6E−06	1.0E+00	1.9E−05	1.6E+00	2.9E−05	1.6E+00	2.8E−05	2.3E+01	4.2E−04	0.0E+00	0.0E+00
SOURCES	4		4		4		4		4		4	

TABLE 5B SUMMARY OF 'AIR TOXIC' EMISSIONS (METALS) FROM WOOD-FIRED BOILERS, CONTD.

	Nickel, Ni		Phosphorus, P		Selenium, Se		Silver, Ag		Thallium, Th		Zinc, Zn	
MILL	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/	lb/
CODE	1E+12 Btu	TDF	1E+12 Btu	TDF	1E+12 Btu	TDF	1E+12 Btu	TDF	1E+12 Btu	TDF	1E+12 Btu	TDF
BOILERS WITHOUT ESPs												
WA							1.2E-01	2.2E-06			7.8E+01	1.4E-03
WB	8.6E+00	1.5E-04			0.0E+00	0.0E+00					3.1E+02	5.6E-03
WC	8.2E+00	1.5E-04			0.0E+00	0.0E+00					2.7E+02	4.9E-03
WD	2.3E+01	4.1E-04			0.0E+00	0.0E+00					9.8E+02	1.8E-02
WE	2.6E+01	4.6E-04			0.0E+00	0.0E+00					7.6E+02	1.4E-02
WF	3.7E+00	6.7E-05			0.0E+00	0.0E+00					2.6E+02	4.6E-03
WG	3.6E+00	6.5E-05			0.0E+00	0.0E+00					4.1E+02	7.4E-03
WK	8.4E+00	1.5E-04			0.0E+00	0.0E+00					3.1E+02	5.7E-03
EPA1	2.6E+02	4.6E-03					2.6E+00	4.6E-05				
EPA2	3.5E+02	5.2E-03					2.3E+03	3.4E-02				
EPA3	5.6E+02	6.4E-03					2.8E+01	3.2E-04				
WN1	ND[3.7]	ND[6.6E-5	1.6E+02	2.9E-03	ND[3.7]	ND[6.6E-5	ND[3.7]	ND[6.6E-5	ND[3.7]	ND[6.6E-5]		
WO1	1.4E+02	2.5E-03			5.6E+00	1.0E-04	1.4E+02	2.5E-03			7.8E+03	1.4E-01
AVG	1.2E+02	1.7E-03	1.6E+02	2.9E-03	8.3E-01	1.5E-05	4.1E+02	6.2E-03	ND[3.7]	ND[6.6E-5	1.2E+03	2.2E-02
MAX	5.6E+02	6.4E-03	1.6E+02	2.9E-03	5.6E+00	1.0E-04	2.3E+03	3.4E-02			7.8E+03	1.4E-01
MIN	0.0E+00	0.0E+00	1.6E+02	2.9E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00			7.8E+01	1.4E-03
SOURCES	12		1		9		6		1		9	
BOILERS WITH ESPs												
WH	2.7E+00	4.8E-05			0.0E+00	0.0E+00					4.6E+01	8.2E-04
WI	6.3E+00	1.1E-04			0.0E+00	0.0E+00					4.5E+01	8.1E-04
WJ	1.7E+00	3.0E-05			0.0E+00	0.0E+00					1.1E+01	2.0E-04
WL	4.1E+00	7.4E-05			3.8E+00	6.8E-05					2.8E+01	5.1E-04
AVG	3.7E+00	6.6E-05			9.5E-01	1.7E-05					3.3E+01	5.9E-04
MAX	6.3E+00	1.1E-04			3.8E+00	6.8E-05					4.6E+01	8.2E-04
MIN	1.7E+00	3.0E-05			0.0E+00	0.0E+00					1.1E+01	2.0E-04
SOURCES	4				4						4	4

ncasi technical bulletin

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC.
P.O. BOX 13318, RESEARCH TRIANGLE PARK, NC 27709-3318

COMPILATION OF 'AIR TOXIC' AND TOTAL HYDROCARBON EMISSION DATA FOR SOURCES AT CHEMICAL WOOD PULP MILLS

VOLUME 1
AND
VOLUME 2

TECHNICAL BULLETIN NO. 701

OCTOBER 1995

H. Sulfite Pulping Area Sources

Table 10 presents volatile organic compound emission data from sulfite pulping area sources. Emission sources for which data were available include two redstock washers, two nuisance scrubbers, one bleach plant, one combined digester evacuation vent and one combined blow pit vent. These data should be used with caution since only information from two mills was available. All the emission data for these two mills were obtained during the NCASI MACT study, and these have been described in detail in NCASI Technical Bulletin No. 682 (19). A total of 28 volatile organics were measured in the emissions of these sulfite pulping area sources. Total hydrocarbon emissions and emissions of terpenes were also measured. Methanol is, once again, the dominant VOC emitted.

VII CHEMICAL RECOVERY AREA SOURCES

A. Black Liquor Oxidation Systems

Table 11 presents volatile organic emissions data for 16 black liquor oxidation (BLOX) systems. All 16 systems oxidized strong black liquor. Most of the 16 systems use single stage oxidation. A total of 71 volatile organic compounds were identified in the emissions from these 16 BLOX systems, as well as H_2S and other reduced sulfur compounds such as CS_2 and COS. Emissions of total hydrocarbons from six BLO tank vents and terpenes from five tank vents are also shown in Table 11. The most dominant VOC emitted is methanol, with a median emission factor of 0.24 lb/TBLS (ton of BLS). Single source measurements should be used with caution.

VOC emissions from BLOX systems are most likely largely due to their presence in the black liquor itself. The level of gas-liquid agitation and the vent gas flow rate will also influence these emissions. Oxidation of dissolved lignin in the BLOX reactor is also expected to contribute, but to a lesser extent. Volatile organic compounds present in black liquor vary with the type of wood (hardwood or softwood) pulped, the geographic location of the wood species (north vs south) and the quality of the raw chemicals used in the kraft pulping process.

B. Kraft DCE Recovery Furnaces

Table 12A presents data for volatile organic compound emissions from 21 kraft recovery furnace stacks where each furnace had a direct-contact evaporator (DCE). Three of the stacks had multiple recovery furnaces venting through them. Each of these DCE recovery furnaces is equipped with a wet bottom precipitator (ESP). Two mills with DCE recovery furnaces have a wet scrubber following the precipitator.

Table 12A includes emissions data for 68 different volatile organic compounds. It also includes emissions data for HCl, reduced sulfur compounds, PAHs, H_2SO_4, terpenes and total

ncasi technical bulletin

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COMPILATION OF 'AIR TOXIC' AND TOTAL HYDROCARBON EMISSIONS DATA FOR SOURCES AT CHEMICAL WOOD PULP MILLS

VOLUME 2

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS

MILL CODE	TEST DATE	MILLION lb BLS/d	WOOD TYPE	LIQUOR TYPE	REFERENCE
BLOA	1991	2.5	SW	STRONG	8
BLOB	1991	2.7	SW	STRONG	8
BLOD	1990	2.9	HW/SW	STRONG	9
BLOE	1990	2.5	HW/SW	STRONG	9
BLOF	1992	4.1	HW/SW	STRONG	9
BLOH	1992	3.5	HW/SW	STRONG	9
BLOI	1992	1.9	SW	STRONG	3
BLOJ	1993	4.6	SW	STRONG	9
BLOK	1992	1.3	SW	STRONG	37
BLOMD	1994	1.7	HW/SW	STRONG	17
BLOMH	1994	2.1	SW	STRONG	17
BLOIC	1993	5.2	HW/SW	STRONG	9
BLOID	1993	3.9	HW/SW	STRONG	9
BLOIE	1993	2.5	HW/SW	STRONG	9
BLOIF	1993	2.6	HW/SW	STRONG	9
BLOIG	1993	4.7	HW/SW	STRONG	9

References

3. Texas Emissions Speciation Study, Emission Test Results, Roy F. Weston, Inc., January 1993.
8. Tests conducted by NCASI in 1991.
9. Individual Mill Testing for 'Air Toxics' - NCASI Mill File Information.
17. Volatile Organic Emissions from Pulp and Paper Mill Sources - Part VI - Kraft Recovery Furnaces and Black Liquor Oxidation Systems, NCASI Technical Bulletin No. 680, October 1994.
37. Emissions Testing of Combustion Processes in a Pulp and Paper Facility, Champion Intntl, Roanoke Rapids, NC, USEPA, EMB Report 92-KPM-27, Oct. 1992.

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

VOLATILE ORGANIC COMPOUND		MILL CODE	EMISSIONS RANGE lb/ton BLS	AVG lb/ton BLS	TEST METHOD	COMMENTS
ACETALDEHYDE		BLOF	0.143 to 0.168	1.5E-01	RTI DRAFT	
ACETALDEHYDE		BLOK	28.4 to 33.9 ppm	4.7E-02	M0011	
ACETALDEHYDE		BLOMD		2.2E-02	IMPINGER	NCASI METHOD
ACETALDEHYDE		BLOMH		6.0E-02	HEATED CANISTER	FID
ACETALDEHYDE		BLOIC	0.002 to 0.003	2.4E-03	IMPINGER	DNPH
ACETALDEHYDE		BLOID	0.016 to 0.017	1.6E-02	IMPINGER	DNPH
ACETALDEHYDE		BLOIE	0.021 to 0.104	6.6E-02	IMPINGER	DNPH
ACETALDEHYDE		BLOIF	0.017 to 0.023	2.1E-02	IMPINGER	DNPH
ACETALDEHYDE		BLOIG	0.006 to 0.033	2.1E-02	IMPINGER	DNPH
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
9	9		2.0E-03 to 1.7E-01	2.2E-02		
ACETONE		BLOA	0.042 to 0.057	5.1E-02	IMPINGER	NCASI METHOD
ACETONE		BLOB	0.014 to 0.018	1.6E-02	IMPINGER	NCASI METHOD
ACETONE		BLOF	0.023 to 0.033	2.7E-02	RTI DRAFT	
ACETONE		BLOI	0.025 to 0.075	5.0E-03	M18	
ACETONE		BLOJ	0.012 to 0.017	1.5E-02	MOD NIOSH 2000	
ACETONE		BLOK	2.5 to 4.5 ppm	6.2E-03	VOST	1.5E-02 by M0011
ACETONE		BLOMD		4.3E-02	HEATED CANISTER	FID
ACETONE		BLOMH		3.1E-02	HEATED CANISTER	FID
ACETONE		BLOIC		ND[0.001]	IMPINGER	DNPH
ACETONE		BLOID	0.019 to 0.020	1.9E-02	HEATED CANISTER	FID
ACETONE		BLOIE	0.063 to 0.097	8.2E-02	HEATED CANISTER	FID
ACETONE		BLOIF	0.005 to 0.010	8.0E-03	IMPINGER	DNPH
ACETONE		BLOIG	0.003 to 0.016	8.6E-03	IMPINGER	DNPH
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
13	12		ND to 0.097	1.6E-02		
ACETOPHENONE		BLOF		ND[1.1E-3]	RTI DRAFT	
ACETOPHENONE		BLOK	86 to 174 ppb	5.5E-04	SEMI-VOST	
ACETOPHENONE		BLOIC		ND[1.8E-4]	IMPINGER	DNPH
ACETOPHENONE		BLOID		ND[3.5E-3]	HEATED CANISTER	FID, [0.00015] by DNPH
ACETOPHENONE		BLOIE	ND to 7.0E-04	4.5E-04	IMPINGER	DNPH
ACETOPHENONE		BLOIF		ND[1.3E-2]	HEATED CANISTER	FID, [0.00039] by DNPH
ACETOPHENONE		BLOIG		ND[1.1E-2]	HEATED CANISTER	FID, [0.00023] by DNPH
NO. OF TESTS	DETECTS		RANGE	MEDIAN**		
7	2		ND to 5.5E-04	8.6E-05		
ACROLEIN		BLOF		ND[1.1E-3]	RTI DRAFT	
ACROLEIN		BLOK	13.3 to 20.6 ppb	3.1E-05	M0011	
ACROLEIN		BLOMH		ND[5.8E-5]	HEATED CANISTER	FID
ACROLEIN		BLOIC		ND[8.3E-5]	IMPINGER	DNPH
ACROLEIN		BLOID		ND[1.7E-3]	HEATED CANISTER	FID, ND[7.3E-05] by DNPH
ACROLEIN		BLOIE		ND[3.1E-4]	IMPINGER	DNPH
ACROLEIN		BLOIG		ND[1.3E-4]	IMPINGER	DNPH
NO. OF TESTS	DETECTS		RANGE	MEDIAN**		
7	1		ND to 3.1E-05	1.6E-06		
ANILINE		BLOK		ND	SEMI-VOST	
BENZALDEHYDE		BLOF	0.002 to 0.004	3.2E-03	RTI DRAFT	
BENZALDEHYDE		BLOK	732 to 843 ppb	2.8E-03	M0011	
BENZALDEHYDE		BLOIC		ND[1.6E-4]	IMPINGER	DNPH
BENZALDEHYDE		BLOID	ND to 1.7E-4	1.0E-04	IMPINGER	DNPH
BENZALDEHYDE		BLOIE	ND to 4.4E-3	2.6E-03	IMPINGER	DNPH
BENZALDEHYDE		BLOIF	3.4E-4 to 7.1E-4	5.2E-04	IMPINGER	DNPH
BENZALDEHYDE		BLOIG	ND to 4.6E-4	2.1E-04	IMPINGER	DNPH
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
7	6		ND to 4.4E-03	5.2E-04		

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

VOLATILE ORGANIC COMPOUND		MILL CODE	EMISSIONS RANGE lb/ton BLS	EMISSIONS AVG lb/ton BLS	TEST METHOD	COMMENTS
BENZENE		BLOF		ND[1.2E-03]	M18	
BENZENE		BLOI	16 ppb	1.9E-05	VOST	
BENZENE		BLOK	2.3 to 6.2 ppb	1.0E-05	VOST	
BENZENE		BLOMD		4.2E-04	HEATED CANISTER	FID
BENZENE		BLOMH		3.4E-05	HEATED CANISTER	FID
BENZENE		BLOIC		ND[1.0E-3]	HEATED CANISTER	FID
BENZENE		BLOID		ND[2.3E-3]	HEATED CANISTER	FID
BENZENE		BLOIE		ND[1.8E-2]	HEATED CANISTER	FID
BENZENE		BLOIF		ND[8.7E-3]	HEATED CANISTER	FID
BENZENE		BLOIG		ND[7.0E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN*		
10	4		ND to 4.2E-4	2.4E-06		
bis(2-ETHYLHEXYL)PHTHALATE		BLOK		ND	SEMI-VOST	
BROMODICHLOROMETHANE		BLOI	1 ppb	2.4E-06	VOST	
BROMOMETHANE		BLOI	2 ppb	2.8E-06	VOST	
BROMOMETHANE		BLOK	2.0 to 4.7 ppb	9.8E-06	VOST	
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	2		2.8E-06 to 9.8E-06	6.3E-06		
BUTYL BENZYL PHTHALATE		BLOK		ND	SEMI-VOST	
n-BUTYRALDEHYDE		BLOK	1.75 to 2.66 ppm	5.5E-03	M0011	
CARBON DISULFIDE		BLOI	ND to 0.1 lb/hr	2.5E-03	M16	
CARBON DISULFIDE		BLOK	173 to 321 ppb	6.2E-04	VOST	
CARBON DISULFIDE		BLOIC	0.0010 to 0.0012	1.1E-03	HEATED CANISTER	FPD
CARBON DISULFIDE		BLOIG	0.0041 to 0.0045	4.3E-03	HEATED CANISTER	FPD
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
4	4		ND to 0.0045	1.8E-03		
CARBON TETRACHLORIDE		BLOMD		ND[1.3E-3]	HEATED CANISTER	FID
CARBON TETRACHLORIDE		BLOMH		ND[6.4E-4]	HEATED CANISTER	FID
CARBON TETRACHLORIDE		BLOIC		ND[1.9E-3]	HEATED CANISTER	FID
CARBON TETRACHLORIDE		BLOID		ND[4.5E-3]	HEATED CANISTER	FID
CARBON TETRACHLORIDE		BLOIE		ND[3.6E-2]	HEATED CANISTER	FID
CARBON TETRACHLORIDE		BLOIF		ND[1.7E-2]	HEATED CANISTER	FID
CARBON TETRACHLORIDE		BLOIG		ND[1.4E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
7	0		ND	ND		
CARBONYL SULFIDE		BLOIC	0.0010 to 0.0012	1.1E-03	HEATED CANISTER	FPD
CARBONYL SULFIDE		BLOIG	0.0041 to 0.0045	4.3E-03	HEATED CANISTER	FPD
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	2		1.0E-03 to 4.5E-03	2.7E-03		
3-CARENE		BLOI		ND[2.5E-03]	M18	
CHLORINE		BLOK	0.031 to 0.041 ppm	8.7E-05	M26A	Suspect data: Do Not Use
CHLOROBENZENE		BLOMD		5.2E-05	HEATED CANISTER	FID, U
CHLOROBENZENE		BLOMH		ND[3.9E-5]	HEATED CANISTER	FID
CHLOROBENZENE		BLOIC		ND[1.4E-3]	HEATED CANISTER	FID

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

VOLATILE ORGANIC COMPOUND		MILL CODE	EMISSIONS RANGE lb/ton BLS	AVG lb/ton BLS	TEST METHOD	COMMENTS
CHLOROBENZENE		BLOID		ND[3.3E-3]	HEATED CANISTER	FID
CHLOROBENZENE		BLOIE		ND[2.6E-2]	HEATED CANISTER	FID
CHLOROBENZENE		BLOIF		ND[1.3E-2]	HEATED CANISTER	FID
CHLOROBENZENE		BLOIG		ND[1.0E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN**		
7	1		ND to 5.2E-05	2.6E-06		
CHLOROFORM		BLOI	22 ppb	3.9E-05	VOST	
CHLOROFORM		BLOI	0.11 to 0.71 ppb	1.3E-06	VOST	
CHLOROFORM		BLOMD		ND[9.7E-4]	HEATED CANISTER	FID
CHLOROFORM		BLOMH		ND[5.0E-4]	HEATED CANISTER	FID
CHLOROFORM		BLOIC		ND[3.0E-3]	HEATED CANISTER	FID
CHLOROFORM		BLOID		ND[7.0E-3]	HEATED CANISTER	FID
CHLOROFORM		BLOIE		ND[5.5E-2]	HEATED CANISTER	FID
CHLOROFORM		BLOIF		ND[2.7E-2]	HEATED CANISTER	FID
CHLOROFORM		BLOIG		ND[2.2E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN**		
9	2		ND to 3.9E-05	1.7E-07		
CHLOROMETHANE		BLOI	92 ppb	6.8E-05	VOST	
CHLOROMETHANE		BLOK	337 to 670 ppb	9.1E-04	VOST	
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	2		6.8E-05 to 9.1E-04	4.9E-04		
o-CRESOL		BLOIC		ND[1.4E-3]	HEATED CANISTER	FID
o-CRESOL		BLOID		ND[3.2E-3]	HEATED CANISTER	FID
o-CRESOL		BLOIE		ND[2.5E-2]	HEATED CANISTER	FID
o-CRESOL		BLOIF		ND[1.2E-2]	HEATED CANISTER	FID
o-CRESOL		BLOIG		ND[9.8E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
5	0		ND	ND		
CROTONALDEHYDE		BLOK	35 to 142 ppb	1.7E-04	M0011	SYNONYM - 2-BUTENAL
CROTONALDEHYDE		BLOIE	ND to 1.5E-04	8.0E-05	IMPINGER	DNPH
CROTONALDEHYDE		BLOIE		ND[3.7E-4]	IMPINGER	DNPH
CROTONALDEHYDE		BLOIF	3.0E-04 to 6.0E-04	4.7E-04	IMPINGER	DNPH
CROTONALDEHYDE		BLOIG		ND[1.3E-4]	IMPINGER	DNPH
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
5	3		ND to 6.0E-04	8.0E-05		
CUMENE		BLOI		ND[2.5E-3]	M18	
CUMENE		BLOIC		ND[1.5E-3]	HEATED CANISTER	FID
CUMENE		BLOID		ND[3.6E-3]	HEATED CANISTER	FID
CUMENE		BLOIE		ND[2.8E-2]	HEATED CANISTER	FID
CUMENE		BLOIF		ND[1.3E-2]	HEATED CANISTER	FID
CUMENE		BLOIG		ND[1.1E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
6	0		ND	ND		
p-CYMENE		BLOI	7 ppb	1.1E-05	VOST	
p-CYMENE		BLOK	2.2 to 4.4 ppb	1.3E-05	VOST	
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	2		1.1E-05 to 1.3E-05	1.2E-05		
CYCLOHEXANONE		BLOID		ND[1.5E-4]	IMPINGER	DNPH
CYCLOHEXANONE		BLOIE		ND[4.9E-4]	IMPINGER	DNPH
CYCLOHEXANONE		BLOIF		ND[1.2E-4]	IMPINGER	DNPH
CYCLOHEXANONE		BLOIG		ND[1.3E-4]	IMPINGER	DNPH
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
4	0		ND	ND		

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

VOLATILE ORGANIC COMPOUND		MILL CODE	EMISSIONS RANGE lb/ton BLS	EMISSIONS AVG lb/ton BLS	TEST METHOD	COMMENTS
DIBROMOMETHANE		BLOI	1 ppb	2.6E-06	VOST	
DI-n-BUTYL PHTHALATE		BLOK	ND to 2.2 ppb	1.2E-05	SEMIVOST	
1,4-DICHLOROBENZENE		BLOK		ND	SEMIVOST	
1,2-DICHLOROETHANE		BLOMD		ND[2.7E-4]	HEATED CANISTER	FID
1,2-DICHLOROETHANE		BLOMH		ND[1.4E-4]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	0		ND	ND		
2,5-DIMETHYL BENZALDEHYDE		BLOK	11.8 to 19.2 ppb	6.9E-05	M0011	
DIMETHYL DISULFIDE		BLOI	0.005 to 0.0125	1.0E-02	M16	
DIMETHYL DISULFIDE		BLOK	948 to 1510 ppb	3.6E-03	VOST	
DIMETHYL DISULFIDE		BLOMD		1.6E-02	HEATED CANISTER	FID
DIMETHYL DISULFIDE		BLOMH		2.4E-03	HEATED CANISTER	FID
DIMETHYL DISULFIDE		BLOIC	0.020 to 0.030	2.6E-02	HEATED CANISTER	FID
DIMETHYL DISULFIDE		BLOID	0.064 to 0.158	1.3E-01	HEATED CANISTER	FID
DIMETHYL DISULFIDE		BLOIE		ND[0.022]	HEATED CANISTER	FID
DIMETHYL DISULFIDE		BLOIF	0.320 to 0.434	3.7E-01	HEATED CANISTER	FID
DIMETHYL DISULFIDE		BLOIG	0.056 to 0.134	8.4E-02	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
9	8		ND to 0.434	1.6E-02		
DIMETHYLPHTHALATE		BLOK	ND		SEMIVOST	
DIMETHYL SULFIDE		BLOI	ND to 0.0075	2.5E-03	M16	
DIMETHYL SULFIDE		BLOK	299 to 418 ppb	7.6E-04	VOST	
DIMETHYL SULFIDE		BLOMD		9.0E-03	HEATED CANISTER	FID
DIMETHYL SULFIDE		BLOMH		ND[1.1E-3]	HEATED CANISTER	FID
DIMETHYL SULFIDE		BLOIC		ND[7.9E-4]	HEATED CANISTER	FID
DIMETHYL SULFIDE		BLOID	0.070 to 0.075	7.4E-02	HEATED CANISTER	FID
DIMETHYL SULFIDE		BLOIE		ND[1.4E-2]	HEATED CANISTER	FID
DIMETHYL SULFIDE		BLOIF	0.012 to 0.019	1.5E-02	HEATED CANISTER	FID
DIMETHYL SULFIDE		BLOIG	ND to 0.013	6.3E-03	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
9	6		ND to 0.075	2.5E-03		
ETHANOL		BLOF	ND to 0.0324	1.4E-02	M18	
ETHANOL		BLOI	ND to 2.5E-03	2.5E-03	M18	
ETHANOL		BLOIC	ND to 0.0007	5.3E-04	HEATED CANISTER	FID
ETHANOL		BLOID	0.002 to 0.005	3.7E-03	HEATED CANISTER	FID
ETHANOL		BLOIE		ND[1.1E-2]	HEATED CANISTER	FID
ETHANOL		BLOIF		ND[5.2E-3]	HEATED CANISTER	FID
ETHANOL		BLOIG		ND[4.2E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
7	4		ND to 3.2E-2	5.3E-04		
ETHYL BENZENE		BLOF	ND to 0.025	9.2E-03	M18	
ETHYL BENZENE		BLOI	1 ppb	1.5E-06	VOST	
ETHYL BENZENE		BLOK	0.27 to 0.48 ppb	1.2E-06	VOST	
ETHYL BENZENE		BLOID		ND[3.1E-3]	HEATED CANISTER	FID
ETHYL BENZENE		BLOIE		ND[2.5E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
5	3		ND to 0.025	1.2E-06		

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

VOLATILE ORGANIC COMPOUND		MILL CODE	EMISSIONS RANGE lb/ton BLS	EMISSIONS AVG lb/ton BLS	TEST METHOD	COMMENTS
FORMALDEHYDE		BLOF		ND [1.2E-03]	RTI DRAFT	
FORMALDEHYDE		BLOK	91 to 124 ppb	1.0E-03	M0011	
FORMALDEHYDE		BLOIC		ND[2.2E-4]	HEATED CANISTER	FID
FORMALDEHYDE		BLOID	0.0003 to 0.0006	4.5E-04	HEATED CANISTER	FID
FORMALDEHYDE		BLOIE	0.0006 to 0.0009	7.3E-04	HEATED CANISTER	FID
FORMALDEHYDE		BLOIF	0.0009 to 0.0014	1.1E-03	HEATED CANISTER	FID
FORMALDEHYDE		BLOIG	0.0003 to 0.0014	7.8E-04	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
7	5		ND to 0.0014	7.3E-04		
HEXACHLOROCYCLOPENTADIENE		BLOIC		ND[3.5E-3]	HEATED CANISTER	FID
HEXACHLOROCYCLOPENTADIENE		BLOIF		ND[3.1E-2]	HEATED CANISTER	FID
HEXACHLOROCYCLOPENTADIENE		BLOIG		ND[2.5E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
3	0		ND	ND		
HEXACHLOROETHANE		BLOIC		ND[3.0E-3]	HEATED CANISTER	FID
HEXACHLOROETHANE		BLOIF		ND[2.7E-2]	HEATED CANISTER	FID
HEXACHLOROETHANE		BLOIG		ND[2.1E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
3	0		ND	ND		
HEXALDEHYDE		BLOK	32 to 51 ppb	1.4E-04	M0011	
n-HEXANE		BLOI	189 ppb	2.5E-04	VOST	
n-HEXANE		BLOIC		ND[1.1E-3]	HEATED CANISTER	FID
n-HEXANE		BLOID		ND[2.6E-3]	HEATED CANISTER	FID
n-HEXANE		BLOIE		ND[2.0E-2]	HEATED CANISTER	FID
n-HEXANE		BLOIF		ND[9.7E-3]	HEATED CANISTER	FID
n-HEXANE		BLOIG		ND[7.8E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN**		
6	1		ND to 2.5E-04	1.5E-05		
2-HEXANONE		BLOK	12.2 to 25.5 ppb	5.8E-05	VOST	
HYDROGEN CHLORIDE		BLOK	0.16 to 0.21 ppm	2.3E-04	M26A	Suspect data: Do Not Use
HYDROGEN FLUORIDE		BLOK		ND[1.8E-05]	M26A	
HYDROGEN SULFIDE		BLOI	ND to 0.4 lb/hr	5.0E-03	M16	
HYDROGEN SULFIDE		BLOIC	ND to 0.0007	3.2E-04	HEATED CANISTER	FID
HYDROGEN SULFIDE		BLOIG	0.043 to 0.053	4.8E-02	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
3	3		ND to 0.053	5.0E-03		
ISOPROPYL ALCOHOL		BLOID		ND[1.8E-3]	HEATED CANISTER	FID
ISOPROPYL ALCOHOL		BLOIE		ND[1.4E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	0		ND	ND		
METHANOL		BLOA	0.81 to 0.94	8.7E-01	IMPINGER	NCASI METHOD
METHANOL		BLOB	0.12 to 0.22	1.7E-01	IMPINGER	NCASI METHOD
METHANOL		BLOD	-	1.2E-01	NA	
METHANOL		BLOE	-	2.5E-01	NA	

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

VOLATILE ORGANIC COMPOUND		MILL CODE	EMISSIONS RANGE lb/ton BLS	EMISSIONS AVG lb/ton BLS	TEST METHOD	COMMENTS
METHANOL		BLOF	0.86 to 2.10	1.4E+00	M18	
METHANOL		BLOH	0.70 to 0.84	7.7E-01	MOD NIOSH 2000	
METHANOL		BLOI	0.035 to 0.0475	4.5E-02	M18	
METHANOL		BLOJ	0.20 to 0.34	2.9E-01	MOD NIOSH 2000	
METHANOL		BLOK	0.15 to 0.17	1.6E-01	IMPINGER	NCASI METHOD
METHANOL		BLOMD		3.3E-01	HEATED CANISTER	FID
METHANOL		BLOMH		2.1E-01	HEATED CANISTER	FID
METHANOL		BLOIC	0.070 to 0.095	8.7E-02	HEATED CANISTER	FID, coeluted with acetaldehyde
METHANOL		BLOID	0.202 to 0.254	2.4E-01	HEATED CANISTER	FID
METHANOL		BLOIE	0.648 to 0.929	7.6E-01	HEATED CANISTER	FID
METHANOL		BLOIF	1.148 to 1.637	1.3E+00	HEATED CANISTER	FID, coeluted with acetaldehyde
METHANOL		BLOIG	0.389 to 0.476	4.4E-02	HEATED CANISTER	FID, coeluted with acetaldehyde
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
16	16		0.035 to 2.10	2.4E-01		
METHYL ETHYL KETONE		BLOA	0.013 to 0.014	1.4E-02	NCASI METHOD	
METHYL ETHYL KETONE		BLOB	0.005 to 0.006	5.5E-03	NCASI METHOD	
METHYL ETHYL KETONE		BLOF	0.025 to 0.084	4.4E-02	M18	
METHYL ETHYL KETONE		BLOI	883 ppb	9.5E-04	VOST	
METHYL ETHYL KETONE		BLOJ	ND to 0.006	1.8E-03	MOD NIOSH 2000	
METHYL ETHYL KETONE		BLOK	0.89 to 2.12 ppm	3.2E-03	VOST	3.0E-03 by M0011
METHYL ETHYL KETONE		BLOMD		7.2E-03	HEATED CANISTER	FID
METHYL ETHYL KETONE		BLOMH		7.7E-03	HEATED CANISTER	FID
METHYL ETHYL KETONE		BLOIC		ND[9.1E-4]	HEATED CANISTER	FID, 2.3E-04 by DNPH METHOD
METHYL ETHYL KETONE		BLOID	0.005 to 0.006	5.5E-03	HEATED CANISTER	FID, 4.1E-03 by DNPH METHOD
METHYL ETHYL KETONE		BLOIE	ND to 0.020	1.6E-02	HEATED CANISTER	FID, 9.0E-03 by DNPH METHOD
METHYL ETHYL KETONE		BLOIF	0.033 to 0.043	3.6E-02	HEATED CANISTER	FID, 1.5E-03 by DNPH METHOD
METHYL ETHYL KETONE		BLOIG	0.008 to 0.009	8.7E-03	HEATED CANISTER	FID, ND[1.3E-04] by DNPH METH.
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
13	12		ND to 0.084	7.2E-03		
METHYL ISOBUTYL KETONE		BLOF		ND[1.2E-3]	RTI DRAFT	
METHYL ISOBUTYL KETONE		BLOK		5.8E-05	VOST	
METHYL ISOBUTYL KETONE		BLOMD		2.3E-04	HEATED CANISTER	FID
METHYL ISOBUTYL KETONE		BLOMH		1.5E-04	HEATED CANISTER	FID
METHYL ISOBUTYL KETONE		BLOIC		ND[1.3E-3]	HEATED CANISTER	FID, ND[1.5E-04] by DNPH METH.
METHYL ISOBUTYL KETONE		BLOID		ND[2.9E-3]	HEATED CANISTER	FID, ND[1.5E-04] by DNPH METH.
METHYL ISOBUTYL KETONE		BLOIE		ND[2.3E-2]	HEATED CANISTER	FID, ND[4.9E-04] by DNPH METH.
METHYL ISOBUTYL KETONE		BLOIF		ND[1.1E-2]	HEATED CANISTER	FID, 3.1E-04 by DNPH METHOD
METHYL ISOBUTYL KETONE		BLOIG		ND[9.0E-3]	HEATED CANISTER	FID, ND[1.3E-04] by DNPH METH.
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
9	3		ND to 2.3E-4	3.0E-05		
METHYL MERCAPTAN		BLOI	0.01 to 0.0175	1.5E-02	M16	
METHYL MERCAPTAN		BLOMD		1.1E-02	HEATED CANISTER	FID
METHYL MERCAPTAN		BLOMH		ND[8.4E-4]	HEATED CANISTER	FID
METHYL MERCAPTAN		BLOIC	0.004 to 0.006	5.2E-03	HEATED CANISTER	FID
METHYL MERCAPTAN		BLOID		ND[1.4E-3]	HEATED CANISTER	FID
METHYL MERCAPTAN		BLOIE		ND[1.1E-2]	HEATED CANISTER	FID
METHYL MERCAPTAN		BLOIF		ND[5.4E-3]	HEATED CANISTER	FID
METHYL MERCAPTAN		BLOIG		ND[4.4E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
8	3		ND to 0.0175	3.6E-03		
4-METHYL-2-PENTANONE		BLOK	13.0 to 18.8 ppb	5.1E-05	VOST	
2-METHYLPHENOL		BLOK	ND			
METHYLENE CHLORIDE		BLOI	32 ppb	4.1E-05	VOST	
METHYLENE CHLORIDE		BLOK	272 to 507 ppb	1.1E-03	VOST	

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

			EMISSIONS			
VOLATILE ORGANIC COMPOUND		MILL CODE	RANGE lb/ton BLS	AVG lb/ton BLS	TEST METHOD	COMMENTS
METHYLENE CHLORIDE		BLOMD		ND[4.9E-4]	HEATED CANISTER	FID
METHYLENE CHLORIDE		BLOMH		ND[2.5E-4]	HEATED CANISTER	FID
METHYLENE CHLORIDE		BLOIC		ND[1.1E-3]	HEATED CANISTER	FID
METHYLENE CHLORIDE		BLOID	ND to 0.0096	4.8E-03	HEATED CANISTER	FID
METHYLENE CHLORIDE		BLOIE		ND[2.0E-2]	HEATED CANISTER	FID
METHYLENE CHLORIDE		BLOIF		ND[9.5E-3]	HEATED CANISTER	FID
METHYLENE CHLORIDE		BLOIG		ND[7.7E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN*		
9	3		ND to 0.0096	4.4E-05		
NAPHTHALENE		BLOF	ND to 0.020	8.1E-03	M18	
NAPHTHALENE		BLOK		ND	SEMIVOST	
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	1		ND to 0.02	8.1E-03		
PHENOL		BLOE		1.7E-03	NA	
PHENOL		BLOK	88 to 165 ppb	3.5E-04	SEMIVOST	
PHENOL		BLOIC		ND[1.2E-3]	HEATED CANISTER	FID
PHENOL		BLOID		ND[2.8E-3]	HEATED CANISTER	FID
PHENOL		BLOIE		ND[2.2E-2]	HEATED CANISTER	FID
PHENOL		BLOIF		ND[1.1E-2]	HEATED CANISTER	FID
PHENOL		BLOIG		ND[8.5E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN**		
7	2		ND to 0.0017	6.7E-05		
ALPHA-PINENE		BLOF	ND to 0.006	3.6E-03	M18	
ALPHA-PINENE		BLOI	39 ppb	8.0E-05	VOST	
ALPHA-PINENE		BLOK	81.5 to 149 ppb	4.7E-04	VOST	5.1E-04 by SEMI-VOST
ALPHA-PINENE		BLOIC		ND[1.7E-3]	HEATED CANISTER	FID
ALPHA-PINENE		BLOIF		ND[1.5E-2]	HEATED CANISTER	FID
ALPHA-PINENE		BLOIG		ND[1.2E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN*		
6	3		ND to 0.006	4.3E-05		
BETA-PINENE		BLOF	ND to 0.009	3.0E-03	M18	
BETA-PINENE		BLOI	17 ppb	3.4E-05	VOST	
BETA-PINENE		BLOK	20.3 to 42.9 ppb	1.2E-04	VOST	7.3E-05 by SEMI-VOST
BETA-PINENE		BLOIC		ND[1.7E-3]	HEATED CANISTER	FID
BETA-PINENE		BLOIF		ND[1.5E-2]	HEATED CANISTER	FID
BETA-PINENE		BLOIG		ND[1.2E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN*		
6	3		ND to 0.009	1.2E-05		
PROPIONALDEHYDE		BLOK	ND to 56.8 ppb	7.3E-05	M0011	SYNONYM - PROPANAL
PROPIONALDEHYDE		BLOID		ND[7.3E-4]	IMPINGER	DNPH
PROPIONALDEHYDE		BLOID	0.0019 to 0.0020	1.9E-03	IMPINGER	DNPH
PROPIONALDEHYDE		BLOIE	0.0014 to 0.0058	3.7E-03	IMPINGER	DNPH
PROPIONALDEHYDE		BLOIF	0.0015 to 0.0020	1.7E-03	IMPINGER	DNPH
PROPIONALDEHYDE		BLOIG	0.0005 to 0.0023	1.3E-03	IMPINGER	DNPH
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
6	5		ND to 0.0058	1.5E-03		
STYRENE		BLOI	3 ppb	4.7E-06	VOST	
STYRENE		BLOMD		4.7E-04	HEATED CANISTER	FID
STYRENE		BLOMH		3.7E-05	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
3	3		4.7E-6 to 4.7E-4	3.7E-05		

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

VOLATILE ORGANIC COMPOUND		MILL CODE	EMISSIONS RANGE lb/ton BLS	EMISSIONS AVG lb/ton BLS	TEST METHOD	COMMENTS
ALPHA-TERPINEOL		BLOF		ND[1.2E-03]	M18	
ALPHA-TERPINEOL		BLOK	ND to 94.5 ppb	2.9E-04	SEMI-VOST	
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	1		ND to 2.9E-04	2.9E-04		
TETRACHLOROETHYLENE		BLOMD		ND[3.4E-4]	HEATED CANISTER	FID
TETRACHLOROETHYLENE		BLOMH		ND[1.7E-4]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	0		ND	ND		
o-TOLUALDEHYDE		BLOK	91 to 163 ppb	4.7E-04	M0011	
m,p-TOLUALDEHYDE		BLOK	ND to 37.4 ppb	5.8E-05	M0011	
TOLUENE		BLOF	ND to 0.006	2.5E-03	M18	
TOLUENE		BLOI	37 ppb	5.1E-05	VOST	
TOLUENE		BLOK	9.1 to 20.2 ppb	4.4E-05	VOST	
TOLUENE		BLOMD		4.5E-04	HEATED CANISTER	FID
TOLUENE		BLOMH		7.5E-05	HEATED CANISTER	FID
TOLUENE		BLOIC		ND[1.2E-3]	HEATED CANISTER	FID
TOLUENE		BLOID		ND[2.7E-3]	HEATED CANISTER	FID
TOLUENE		BLOIE		ND[2.1E-2]	HEATED CANISTER	FID
TOLUENE		BLOIF		ND[1.0E-2]	HEATED CANISTER	FID
TOLUENE		BLOIG		ND[8.3E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN*		
10	5		ND to 6.0E-03	1.9E-05		
1,2,4-TRICHLOROBENZENE		BLOMD		5.3E-04	HEATED CANISTER	FID
1,2,4-TRICHLOROBENZENE		BLOMH		2.5E-04	HEATED CANISTER	FID, U
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	2		2.5E-04 to 5.3E-04	3.9E-04		
1,1,1-TRICHLOROETHANE		BLOI		ND	VOST	
1,1,1-TRICHLOROETHANE		BLOK	0.30 to 1.31 ppb	2.8E-06	VOST	
1,1,1-TRICHLOROETHANE		BLOMD		ND[2.7E-4]	HEATED CANISTER	FID
1,1,1-TRICHLOROETHANE		BLOMH		ND[1.4E-4]	HEATED CANISTER	FID
1,1,1-TRICHLOROETHANE		BLOIC		ND[1.7E-3]	HEATED CANISTER	FID
1,1,1-TRICHLOROETHANE		BLOID		ND[3.9E-3]	HEATED CANISTER	FID
1,1,1-TRICHLOROETHANE		BLOIE		ND[3.1E-2]	HEATED CANISTER	FID
1,1,1-TRICHLOROETHANE		BLOIF		ND[1.5E-2]	HEATED CANISTER	FID
1,1,1-TRICHLOROETHANE		BLOIG		ND[1.3E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN**		
9	2		ND to 5.4E-06	1.1E-07		
1,1,2-TRICHLOROETHANE		BLOMD		ND[2.7E-4]	HEATED CANISTER	FID
1,1,2-TRICHLOROETHANE		BLOMH		ND[1.4E-4]	HEATED CANISTER	FID
1,1,2-TRICHLOROETHANE		BLOIC		ND[1.7E-3]	HEATED CANISTER	
1,1,2-TRICHLOROETHANE		BLOID		ND[3.9E-3]	HEATED CANISTER	
1,1,2-TRICHLOROETHANE		BLOIE		ND[3.1E-2]	HEATED CANISTER	
1,1,2-TRICHLOROETHANE		BLOIF		ND[1.5E-2]	HEATED CANISTER	
1,1,2-TRICHLOROETHANE		BLOIG		ND[1.2E-2]	HEATED CANISTER	
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
7	0		ND	ND		

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

VOLATILE ORGANIC COMPOUND		MILL CODE	EMISSIONS RANGE lb/ton BLS	EMISSIONS AVG lb/ton BLS	TEST METHOD	COMMENTS
TRICHLOROETHYLENE		BLOMD		2.8E-04	HEATED CANISTER	FID, U
TRICHLOROETHYLENE		BLOMH		ND[1.4E-4]	HEATED CANISTER	FID
TRICHLOROETHYLENE		BLOIC		ND[1.7E-3]	HEATED CANISTER	FID
TRICHLOROETHYLENE		BLOID		ND[3.9E-3]	HEATED CANISTER	FID
TRICHLOROETHYLENE		BLOIE		ND[3.0E-2]	HEATED CANISTER	FID
TRICHLOROETHYLENE		BLOIF		ND[1.5E-2]	HEATED CANISTER	FID
TRICHLOROETHYLENE		BLOIG		ND[1.2E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN**		
7	1		ND to 2.8E-04	1.4E-05		
TRICHLOROFLUOROMETHANE		BLOI	5 ppb	1.0E-05	VOST	
TRICHLOROFLUOROMETHANE		BLOK	0.60 to 0.87 ppb	3.7E-06	VOST	
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
2	2		2.9E-06 to 1.0E-05	6.9E-06		
VALERALDEHYDE		BLOK	107 to 335 ppb	6.6E-04	M0011	SYNONYM - PENTANAL
VALERALDEHYDE		BLOIE	0.001 to 0.0012	1.1E-03	IMPINGER	DNPH
VALERALDEHYDE		BLOIE	0.001 to 0.004	2.6E-03	IMPINGER	DNPH
VALERALDEHYDE		BLOIF	0.0006 to 0.0012	9.2E-04	IMPINGER	DNPH
VALERALDEHYDE		BLOIG	ND to 0.0009	4.2E-04	IMPINGER	DNPH
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
5	5		ND to 0.004	9.2E-04		
ISOVALERALDEHYDE		BLOK	225 to 304 ppb	7.6E-04	M0011	
o-XYLENE		BLOF	ND to 0.029	1.0E-02	M18	
o-XYLENE		BLOI	1 ppb	1.6E-06	VOST	
o-XYLENE		BLOMD		4.4E-04	HEATED CANISTER	FID
o-XYLENE		BLOMH		5.6E-05	HEATED CANISTER	FID
o-XYLENE		BLOIC		ND[1.3E-3]	HEATED CANISTER	FID
o-XYLENE		BLOID		ND[3.1E-3]	HEATED CANISTER	FID
o-XYLENE		BLOIE		ND[2.5E-2]	HEATED CANISTER	FID
o-XYLENE		BLOIF		ND[1.2E-2]	HEATED CANISTER	FID
o-XYLENE		BLOIG		ND[9.6E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN*		
9	4		ND to 0.029	5.2E-07		
m,p-XYLENE		BLOF		ND[1.2E-3]	M18	
m,p-XYLENE		BLOI	ND to 0.023	7.6E-03	M18	
m,p-XYLENE		BLOK	2.9 to 4.7 ppb	1.2E-05	VOST	
m,p-XYLENE		BLOMD		3.7E-04	HEATED CANISTER	FID
m,p-XYLENE		BLOMH		1.1E-04	HEATED CANISTER	FID
m,p-XYLENE		BLOIC		ND[1.3E-3]	HEATED CANISTER	FID
m,p-XYLENE		BLOID		ND[3.1E-3]	HEATED CANISTER	FID
m,p-XYLENE		BLOIE		ND[2.5E-2]	HEATED CANISTER	FID
m,p-XYLENE		BLOIF		ND[1.2E-2]	HEATED CANISTER	FID
m,p-XYLENE		BLOIG		ND[9.6E-3]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN*		
10	4		ND to 0.023	2.2E-06		
TERPENES		BLOMD		2.3E-02	HEATED CANISTER	FID
TERPENES		BLOMH		3.3E-01	HEATED CANISTER	FID
TERPENES		BLOID	ND to 0.005	3.8E-03	HEATED CANISTER	FID
TERPENES		BLOIE	0.066 to 0.134	1.1E-01	HEATED CANISTER	FID
TERPENES		BLOIF		ND[1.5E-2]	HEATED CANISTER	FID
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
5	4		ND to 3.3E-1	2.3E-02		

TABLE 11 SUMMARY OF 'AIR TOXIC' EMISSIONS FROM BLACK LIQUOR OXIDATION TANK VENTS, CONTD.

VOLATILE ORGANIC COMPOUND		MILL CODE	EMISSIONS RANGE lb/ton BLS	EMISSIONS AVG lb/ton BLS	TEST METHOD	COMMENTS
			lb C/ton BLS	lb C/ton BLS		
TOTAL HYDROCARBONS		A		1.5E-01	M25	NCASI Tech. Bull. No. 646
TOTAL HYDROCARBONS		B		2.9E-01	M25	NCASI Tech. Bull. No. 646
TOTAL HYDROCARBONS		D		2.3E-02	M25A	NCASI Tech. Bull. No. 646
TOTAL HYDROCARBONS		H		3.3E-01	M25A	NCASI Tech. Bull. No. 646
TOTAL HYDROCARBONS		BLOK		5.4E-02	M25A	
TOTAL HYDROCARBONS		BLOIC	0.0119 to 0.014	1.3E-02	M25A	
NO. OF TESTS	DETECTS		RANGE	MEDIAN		
6	6		1.2E-02 to 3.3E-01	1.0E-01		

Notes
(a) U - unidentified and unconfirmed by GC/MSD
(b) For BLO units with codes BLOMX (X = A to Q) the heated canister gases were concentrated before analysis on the FID;
(c) For BLO units with codes BLOIX (X = A to J) the heated canister gases were not concentrated before analysis on the FID;
(d) For many mills actual BLS firing rates were unknown; lb/ADTP was converted to lb/ton BLS using a factor of 3250 lb BLS/ADTP;

MEDIAN - empirical median; MEDIAN* - "NORPLOT" median; MEDIAN** - "SDln" median

Table 6.5.2-1 TRS and VOC Emissions from Black Liquor Oxidation Systems (NCASI 2003a)

	No.	Range	Median	Mean
		(lb/ton BLS)		
Total TRS as S	10	6.0E-03 – 0.29	0.023	0.064
Dimethyl Disulfide	10	2.4E-03 – 0.40	0.014	0.068
Dimethyl Sulfide	10	ND – 0.12	6.2E-03	6.3E-03
Hydrogen Sulfide	4	2.0E-04 – 0.046	4.0E-03	7.9E-03
Methyl Mercaptan	9	ND – 0.022	0.01[1]	0.01[1]
Acetaldehyde	9	0.002 – 0.15	0.022	0.045
Formaldehyde	7	ND – 0.0011	7.3E-04	7.2E-04
Methanol	17	0.035 – 2.10	0.25	0.43
MEK	12	ND – 0.043	6.4E-03	8.9E-03
Terpenes	10	ND – 0.11	6.3E-03	7.0E-03
THCs as C[2]	7	1.8E-04 – 3.3E-01	0.054	0.12

Ton BLS – ton black liquor solids; No. – number of sources tested; ND – non-detect;
[1]NDs > 50%; statistically-derived average; [2]as measured by EPA M25A;

6.5.3 Kraft Recovery Furnaces

The first recovery furnace of the current industry-wide design was installed over 70 years ago. Since then there have been many incremental improvements and refinements to this design that have lowered emissions. TRS and particulate matter (PM) emissions received all of the attention until recent years, because of their readily observable nature (odor and visibility). Besides TRS and PM emissions, other significant emissions from the kraft recovery furnace include SO_2, NO_x, CO, volatile organic compounds (VOCs), including HAPs, and hydrochloric acid (HCl).

6.5.3.1 TRS Emissions

Until the mid-1970s, the recovery furnace was the predominant source of TRS emissions at every kraft mill. Although the recovery furnace still can be the largest TRS emission source, emissions have been greatly reduced over the last 25 years (Pinkerton 1999). Three factors have contributed to significant emission reductions. These are a) avoidance of firing black liquor solids at rates far above the furnace design capacity, which caused excessive H_2S emissions, b) widespread adoption of black liquor oxidation to minimize H_2S pick-up across direct contact evaporators, and c) the increasing number of NDCE-type furnace installations. In addition, there have been notable design improvements that have led to better combustion conditions in the furnace. Average concentrations of H_2S in recovery furnace flue gases now range from less than 1 to about 10 ppm for NDCEs (most NDCEs have TRS levels well below 5 ppm), and from 5 to 40 ppm for DCEs with black liquor oxidation. In the United States, TRS concentrations are normally reported at standard conditions of 0% moisture and 8% O_2 concentration rather than at actual stack conditions. Even with low TRS concentrations, the recovery furnace can still have significant mass emissions because of the high flue gas volumes.

For kraft recovery furnaces equipped with wet bottom ESPs, especially NDCE units, TRS emissions can also result from TRS compounds being picked up due to inadvertent contact between the unoxidized black liquor and the furnace flue gases as the latter pass through the ESP. Modifications to the duct work

and internal baffling that minimize contact between the flue gases and the unoxidized liquor may alleviate this problem (EPA 1983). Other remedies include replacement of the liquor with water in the bottom of the ESP and conversion of the ESP from a wet bottom to a dry bottom.

6.5.3.2 Particulate Emissions

Recovery furnaces are designed and operated in a manner so as to ensure the presence of high levels of sodium fumes in order to capture the sulfur dioxide which is produced as a result of oxidation of reduced sulfur compounds. Consequently, recovery furnace flue gases contain high levels of particulate matter. The uncontrolled particulate matter load from recovery furnaces is highly variable and has been reported to range from 100 to 250 lb/ODTP for DCE furnaces and 200 to 450 lb/ODTP for non-DCE furnaces. The lower particulate loading from DCE furnaces is due to the capture of some particulate matter in the direct contact evaporator.

It has been reported that increasing liquor firing density (ton/day/ft^2) increases recovery furnace particulate loading (Nguyen and Rowbottom 1979). Other factors such as bed and furnace temperature, liquor solids, liquor composition and air distribution also affect uncontrolled particulate emissions from recovery furnaces.

Particulates generated in the recovery furnace are comprised mainly of sodium sulfate, with lesser amounts of sodium carbonate and sodium chloride. Similar potassium compounds are also generated, but in much lower amounts. Trace amounts of other metal compounds (e.g., magnesium, calcium and zinc) can be present. The sodium compounds originate from condensation of the gaseous sodium fume released from the smelt bed and from ash generated during combustion of liquor droplets carried upward in the furnace. A significant portion of the particulate material is sub-micron in size, which makes removal with add-on control devices more difficult. The material also has a "sticky" characteristic that promotes adhesion to boiler steam tubes and other surfaces. Soot blowing is required to dislodge this material.

Table 6.5.3.2-1 provides some data on composition of particulate matter emissions from recovery furnaces captured in electrostatic precipitators (Thompson, Paleologou, and Berry 1997). At the two mills in this study, one an interior mill and the other a coastal mill, much higher levels of chloride are seen compared with carbonate. The alkalinity of recovery furnace particulate matter (which depends on its carbonate content) is influenced by the sulfur dioxide concentrations in the flue gases. As the level of sulfur dioxide increases, it reacts with sodium carbonate to produce sodium sulfate.

The particulate matter produced in recovery furnaces is the result of complex reactions between sodium fumes and gases produced from combustion. From 67 to 77% and from 50 to 53% of the total mass of particulate in the flue gases is contributed by particles less than 10 μm and less than 2.5 μm in size, respectively (NCASI 2004).

Table 6.5.3.2-1 Composition of Particulate Matter Captured in Kraft Recovery Furnace Electrostatic Precipitators
(Thompson, Paleologou, and Berry 1997)

	ESP Catch Composition, wt.-%	
	Interior Mill	Coastal Mill
Sodium	30.0	29.7
Potassium	3.3	3.2
Calcium	0.009	0.005
Iron	0.007	0.055
Manganese	0.003	0.002
Magnesium	0.003	0.003
Chromium	0.002	0.002
Nickel	N.D.	<0.001
Copper	N.D.	N.D.
Aluminum	N.D.	N.D.
Lead	<0.005	N.D.
Sulfate	63.5	46.6
Chloride	0.73	14.3
Carbonate	0.24	N.D.
Water	0.12	0.2
Organics	N.A.	0.09
Total	**97.9**	**94.2**

N.D. = not detected
N.A. = not analyzed

6.5.3.3 SO_2 Emissions

Black liquor contains a significant amount of sulfur, nominally 3 to 5% by weight of the dissolved solids. While the vast majority of this sulfur leaves the furnace in the smelt, a small fraction (generally under 1%) can escape in gaseous or particulate form. Average SO_2 concentrations in stack gases can range from nearly 0 to 500 ppm. Factors which influence SO_2 levels are liquor sulfidity, liquor solids content, stack oxygen content, furnace load, auxiliary fuel use, and furnace design. None of these factors has exhibited a consistent relationship with SO_2 emissions (NCASI 1991). On average, SO_2 emissions from NDCE units tend to be lower than from DCE units. Gaseous sulfuric acid may exist in recovery furnace flue gases as a result of a reaction between sulfur trioxide and water vapor, the SO_3 being formed in small amounts from further oxidation of SO_2. However, kraft recovery furnace gaseous H_2SO_4 concentrations are typically small, on the order of 1 ppm (NCASI 1980, 1995).

6.5.3.4 NO_x Emissions

Nitrogen in black liquor ranges from about 0.05 to 0.25% of the liquor solids content, typically averaging about 0.1%. During black liquor combustion, nearly three fourths of the liquor nitrogen is released during pyrolysis or devolatilization, partly as ammonia and partly as N_2. The NH_3 released partly oxidizes to NO and partly reduces to N_2. The remaining liquor nitrogen will be bound in the char residue, mostly as a reduced species in the salt residue or smelt. Forssen et al. (1997) have suggested that the oxidation of the NH_3 released during pyrolysis is perhaps the main contributor to the overall NO formation during normal black liquor combustion. Overall conversions of black liquor nitrogen to NO are quite low compared

with other fuels, ranging from 10 to about 25%. NO_x levels are typically somewhat higher for NDCE furnaces than DCE units. Besides the older ages of the DCE units and perhaps a less robust combustion temperature environment, the reasons for this are unclear.

6.5.3.5 Ammonia Emissions

As the combustion gas passes upward through the oxidizing zones of the furnace, most of the NH_3 formed during devolatilization of black liquor droplet nitrogen is oxidized to NO or reduced to N_2. However, small amounts of ammonia (NH_3) could potentially escape unreacted. There is limited evidence suggesting NH_3 may be present in the flue gas as it exits the upper furnace (Lovblad et al. 1991). Additional study is needed on this phenomenon.

6.5.3.6 CO Emissions

Carbon monoxide is a product of incomplete combustion. Complete combustion would result in all of the organic carbon in the black liquor being converted to CO_2. CO emissions from recovery furnaces have been found to fluctuate markedly with time, and long-term mean values vary considerably from furnace to furnace. CO levels are affected by swings in liquor firing rates and liquor solids content. Empirical evidence suggests a loose positive correlation between CO and TRS emissions.

6.5.3.7 VOC Emissions

Volatile organic compounds (VOCs) are emitted in small amounts from recovery furnaces. The source of these compounds may be incomplete combustion or the liquor itself when it comes into contact with combustion gases. The most obvious contact between liquor and flue gas is in the DCE, where methanol and other volatiles can be transferred from the liquor to the flue gas. Less obvious contact occurs in the bottom of electrostatic precipitators where black liquor is used to collect the captured ash, and in furnaces that use liquor to transfer ash removed from the upper furnace areas to the salt cake mix tank. An early NCASI study (NCASI 1981) showed a) VOC emissions from kraft recovery furnaces could not be correlated to the black liquor firing rate or excess air usage, and b) VOC emissions from NDCE furnaces correlated with CO emissions, although the significance of this was not well understood.

6.5.3.8 HCl Emissions

Chlorides are present in black liquor. Sources of this chloride include wood chips, purchased caustic, purchased salt cake, mill water, and spent chlorine dioxide generator acid. When the liquor is combusted, the chlorides will partition to the smelt, to particulate matter in flue gases, and to gaseous form. Studies indicate about 75% of the chlorides will be retained in the smelt (NCASI 1994b), with most of the remainder being carried out of the furnace in particulate form, mainly as NaCl with some KCl. The particulates are captured by the ESP and DCE (if present) and returned to the liquor being fired. Anywhere from 0 to 8 % of the chlorides present in the as-fired liquor will exit as gaseous HCl. Concentrations in stack flue gases range from 0.1 to about 50 ppm (at standard conditions). For NDCE furnaces, the amount of HCl in the flue gas has been found to correlate closely with the concentration of SO_2. Furnaces with very low SO_2 emissions also have very low HCl emissions (NCASI 1994b).

6.5.3.9 PCDD/F Emissions

Due to the presence of organics and chlorides in black liquor, the possibility for formation of other chlorinated compounds in the recovery furnace has always been known to exist, although the amounts measured thus far have been extremely small. Comprehensive emission measurements have shown concentrations of gaseous chlorinated organic compounds (e.g., chloroform) to be below method

detection limits in nearly all cases (NCASI 1995). EPA has focused a great deal of attention on polychlorinated dibenzo-dioxins and -furans (PCDD/Fs) over the past decade, but data on measurements provided to EPA by NCASI have shown kraft recovery furnaces to have minimal emissions of these compounds (EPA 1997).

Table 6.5.3.9-1 gives estimates of emissions from DCE and NDCE kraft recovery furnaces for TRS, THCs, SO_2, NO_x, CO, PM, acid gases H_2SO_4 and HCl, PCDD/Fs and several VOCs of significance.

Table 6.5.3.9-1 TRS, SO_2, NO_x, CO, PM, Acid Gas, PCDD/F and VOC Emissions from Kraft Recovery Furnaces
(NCASI 2003a, 2004)

	DCE Kraft Recovery Furnaces				NDCE Kraft Recovery Furnaces			
	No.	Range	Median	Mean	No.	Range	Median	Mean
		(lb/ton BLS)				(lb/ton BLS)		
Total TRS as S	18	0.055 – 0.33	0.075	0.11	13	ND – 0.17	4.7E-03	0.016
Dimethyl Disulfide	18	ND – 0.069	3.6E-03[8]	3.6E-03[8]	13	ND - 0.044	2.4E-04[8]	2.4E-04[8]
Dimethyl Sulfide	18	ND – 0.079	6.7E-04[8]	6.7E-04[8]	13	ND – 0.033	6.8E-04[8]	6.8E-04[8]
Hydrogen Sulfide	8	0.02 – 0.26	0.059	0.082	5	ND – 0.13	3.4E-03	0.016
Methyl Mercaptan	18	ND – 0.23	0.025	0.042	13	ND – 0.054	1.5E-03[8]	1.5E-03[8]
VOC[1]	12	0.01 – 1.50	0.21	0.39	19	ND – 1.07	0.09	0.15
SO_2	7	1.10 - 3.58	2.29	2.12	46	0.00 – 5.36	0.22	0.74
NO_x[2]	1	–	1.09	1.09	28	0.64 – 3.19	1.50	1.52
CO[3]	19	0.10 - 6.88	1.21	2.20	19	0.10 - 6.88	1.21	2.20
TPM[4]	23	0.07 – 2.58	0.70	0.74	20	0.02 – 3.50	0.37	0.65
CPM[5]	2	0.21 – 0.68	0.44	0.44	6	0.04 – 0.18	0.063	0.08
PM_{10}[6]	4		76.8%	75.0%	13		71.3%	67.2%
$PM_{2.5}$[6]	4		53.4%	52.9%	10		49.8%	51.0%
Acetaldehyde	9	ND – 0.071	0.019	0.023	14	ND – 0.05	4.2E-04[8]	4.2E-04[8]
Benzene	18	ND – 0.053	3.3E-03	0.01	13	ND – 0.025	6.4E-04[8]	6.4E-04[8]
Formaldehyde	7	ND – 0.0096	9.6E-04[8]	9.6E-04[8]	9	ND – 0.044	7.8E-03	6.6E-03
Hydrogen Chloride	19	ND – 0.55	0.085	0.13	27	ND – 1.23	0.055	0.25
Methanol	23	ND – 1.35	0.19	0.28	17	ND – 0.23	0.044	0.045
MEK	17	ND – 0.035	8.3E-03	9.6E-03	15	ND – 7.1E-03	9.4E-04[8]	9.4E-04[8]
Sulfuric Acid	5	ND – 0.047	0.01	0.011	6	ND – 0.071	0.02	0.028
PCDD/Fs[7]	4	0.0016 – 0.01	4.9E-03	5.4E-03	7	1.8E-05 – 0.01	2.0E-03	2.9E-03

ton BLS – ton black liquor solids; No. – number of sources tested; ND – non-detect; [1]as measured by EPA M25A; [2]a 1992 EPA Survey Questionnaire yielded average NO_x emissions from 16 DCE furnaces of about 57.4 ppm @ 8% O_2 (range 30 to 110) or about 1.20 lb/t bls (range 0.63 to 2.30); [3]same for DCE and NDCE furnaces; [4]total (filterable) particulate matter; [5]CPM (condensible particulate matter); [6]PM_{10} & $PM_{2.5}$ as determined using EPA Draft Method for determining PM_{10} & $PM_{2.5}$ - expressed as % of TPM; [7]units for PCDD/Fs are in I-TEQ ng/dscm @ 8% O_2; [8]NDs > 50%; statistically-derived average

6.5.3.10 Trace Metal Emissions

Trace metals enter the kraft recovery cycle through the wood pulped, make-up water, make-up chemicals, equipment corrosion, and fossil fuels used in recovery furnaces and lime kilns. When black liquor is burned in a recovery furnace, a small fraction of the trace metals in the liquor will be emitted through the flue gases leaving the ESP. Typically, metal purges via emissions from kraft recovery unit operations, which includes the recovery furnace, lime kiln and smelt dissolving tank, are much smaller than through pulping and recovery area solid wastes such as waste treatment system residuals, lime mud, slaker grits and dregs (Someshwar 1997). Table 6.5.3.10-1 provides a summary of recently compiled trace metals emissions data corresponding to several DCE and NDCE kraft recovery furnaces (NCASI 2003a).

It should be noted that kraft recovery furnaces have auxiliary fuel (natural gas, residual oil or distillate oil) burning capability for the purposes of furnace startup and shutdown. Auxiliary fuel may also be used to stabilize combustion when there are problems with the liquor supply and to maintain steam production if liquor firing is inadequate. Firing of auxiliary fuel can result in additional emissions of NO_x. SO_2 generated from fuel oil combustion is captured within the furnace to a significant extent by the sodium fume when the oil is burned in conjunction with black liquor or when the smelt bed is still present at the bottom of the furnace (NCASI 1990a). This capture does not take place during furnace startup on oil, since there is no smelt bed present. Oil also contains trace amounts of many metals which can contribute to emissions of metals compounds.

Table 6.5.3.10-1 Trace Metal Emissions from Kraft Recovery Furnaces
(NCASI 2003a)

	DCE Kraft Recovery Furnaces				NDCE Kraft Recovery Furnaces			
	No.	Range	Median	Mean	No.	Range	Median	Mean
		(lb/ton BLS)				(lb/ton BLS)		
TPM[1]	12	0.07 – 1.10	0.47	0.49	11	0.02 – 3.50	0.32	0.57
Sb	12	1.9E-07 – 7.0E-05	4.2E-08[2]	4.2E-08[2]	11	ND – 4.5E-06	1.5E-06[2]	1.5E-06[2]
As	12	ND – 2.1E-05	3.0E-06	5.8E-06	11	ND – 5.4E-04	1.3E-08[2]	1.3E-08[2]
Be	12	–	ND[6.0E-07]		9	5.9E-08 – 1.2E-06	1.3E-08[2]	1.3E-08[2]
Cd	12	ND – 8.1E-05	1.0E-05	1.4E-05	11	ND – 4.8E-05	7.1E-06	1.2E-05
Cr	11	4.4E-06 – 9.0E-05	1.2E-05	2.7E-05	9	2.7E-06 – 3.8E-05	1.9E-05	1.7E-05
Co	10	ND – 8.4E-06	2.8E-06	2.9E-06	11	ND – 7.7E-06	2.8E-06	3.2E-06
Pb	12	2.3E-06 – 5.3E-05	6.3E-06	1.0E-05	11	1.1E-06 – 7.0E-05	1.2E-05	2.3E-05
Mn	12	7.0E-06 – 1.0E-04	4.1E-05	4.1E-05	10	5.4E-06 – 1.7E-04	5.2E-05	5.9E-05
Hg	12	–	ND[1.3E-07]		10	ND – 7.0E-06	2.0E-06	2.0E-06
Ni	10	4.9E-06 – 3.9E-05	1.4E-05	1.8E-05	9	8.8E-06 – 6.2E-05	3.2E-05	2.8E-05
Se	12	ND – 1.8E-05	2.2E-06[2]	2.2E-06[2]	11	ND – 2.2E-04	8.0E-07[2]	8.0E-07[2]

ton BLS – ton black liquor solids; No. – number of sources tested; ND – non-detect;
[1]total (filterable) particulate matter – measured simultaneously with trace metals; [2]NDs > 50%; statistically-derived average

6.5.3.11 Solid and Liquid Discharges

Solid and liquid discharges are generally not expected from the kraft recovery furnace. A portion of the ash captured in particulate collection devices may occasionally be sent to a landfill. One reason this is done is to purge the buildup of chlorides and potassium in the liquor cycle. Typical compositions of ESP ash were given in Table 6.5.3.2-1. Besides liquor losses, no other liquid discharges are expected from the recovery furnace. For furnaces where a wet scrubber follows the ESP, liquid discharges could result from the purge in the scrubber recycle stream. For recovery furnaces that also generate electricity, wastewater streams typical of smaller industrial electricity generating plants would be present. These include ion exchange regeneration waste, boiler blowdown, and cooling system blowdown (Stultz and Kitto 1992). Ion exchange regeneration wastewater streams are normally neutralized prior to discharge.

6.5.4 Smelt Dissolving Tanks

The significant emissions from a dissolving tank vent are TRS compounds and particulate matter. Trace amounts of ammonia emissions have also been measured. VOC emissions are generally very low, unless process condensates containing significant VOCs are used to either dissolve the smelt or for scrubbing the vent gases.

6.5.4.1 TRS Emissions

TRS compounds arise principally from the sulfides present in smelt and in weak wash. H_2S is the main compound present in smelt tank vent gases, with typical concentrations measured in the range of 5 to 20 ppm. It is believed generated mainly by the shattering of smelt (Frederick, Danko, and Ayers 1996). However, if TRS- containing condensates are used in the recausticizing area, higher levels of TRS compounds could be present in the weak wash, providing greater potential for stripping of these compounds during smelt dissolving or vent gas scrubbing operations. Methyl mercaptan, dimethyl sulfide and dimethyl disulfide can be present in smelt tank vent gases if they are present in the weak wash as a result of condensate reuse.

6.5.4.2 Particulate Emissions

As with the recovery furnace, particulates are comprised of mainly sodium compounds with much lesser amounts of potassium compounds and some other trace metal compounds. The dominant compound is sodium carbonate, followed by sodium sulfate. Roughly 90% (by weight) of the particles have equivalent aerodynamic diameters under 10 μm, and 50% have diameters under 1 μm (Pinkerton and Blosser 1981; NCASI 1978a).

6.5.4.3 Other Gaseous Emissions

Volatile organic compounds such as methanol can be released from the weak wash in both the dissolving tank and the wet scrubber particulate control device. In a study of emissions from four smelt dissolving tanks, NCASI found methanol emissions were closely related to the methanol content of the weak wash used in the scrubbers (NCASI 1994c). Ammonia has been found in the smelt dissolving tank exhaust, although amounts appear to be highly variable with measured emission rates ranging from around 0.02 to 3.8 lb/ton BLS (NCASI 1999a).

Some mills have made measurements for NO_x, CO and SO_2 in smelt dissolving tank vents. However, since no combustion takes place in smelt tanks, and smelt-water explosions are not known to result in NO_x, the low level of NO_x sometimes measured is believed to be an artifact caused by oxidation of a portion of the ammonia (NH_3) emissions from such tanks to NO within the NO_x analyzer (NCASI 2003b).

10.2.2 Wood Residues

The majority of chemical wood pulp mills that debark logs on-site burn the bark and other wood residues in boilers to generate steam and power. Although smaller boiler types such as the Dutch oven and fuel cell oven are sometimes utilized, the majority of boilers with steam generation rates exceeding 100,000 lb/hr are of the spreader stoker type. At pulp and paper mills in 2004, there were 14 Dutch ovens, 13 fluidized bed boilers, 40 pulverized coal-fired boilers, and 129 spreader stokers that burned wood fuels. Most of these units routinely fired some fossil fuels as well as wood.

When wood is burned alone, the principal emissions of concern are particulates, CO and NO_x. The ash content of bark is on the order of 1 to 2%, about an order of magnitude lower than coal. Particulate emissions result from inorganic materials contained in the bark and wood itself and from carbonaceous material resulting from incomplete combustion. Like coal, uncontrolled particulate emissions will be greater where fly ash reinjection is practiced.

NO_x emissions are mainly the result of "fuel NO_x", with wood and bark nitrogen contents being in the 0.1 to 0.2% range. However, certain types of wood residues, e.g., juvenile woods, may have nitrogen contents in the 0.2 to 0.4% range. Average NO_x emissions from wood combustion in typical pulp mill boilers are lower than those from coal or residual oil combustion, and slightly higher than average NO_x emissions from natural gas burning. However, if any wood fuels containing nitrogen from other sources (e.g., sanderdust from panels bonded with urea formaldehyde resin) are burned, higher NO_x emissions can be expected.

SO_2 emissions from wood combustion are very low, since bark and other wood residues contain little sulfur (NCASI 1978). CO emissions and other products of incomplete combustion are highly variable and are a function of boiler design, operating conditions, combustion efficiency and fuel quality. HCl emissions are minimal (less than 0.001 lb/10^6 Btu heat input), unless bark from logs stored in salt water or wood material containing resins with NaCl is burned. Table 10.2.2-1 provides estimates of emissions for several criteria pollutants, selected VOCs, and greenhouse gases (CO_2, CH_4, N_20) resulting from wood residue combustion in boilers (EPA 2001). Emissions of trace metals are summarized in Table 10.2.2-2.

While wood is the sole fuel for some pulp mill boilers, most boilers burn wood in combination with one or more fossil fuels. Studies by NCASI have shown that burning wood in combination with coal or oil will result in lower SO_2 emissions than would be expected from the coal or oil combustion. This phenomenon is the result of in-furnace SO_2 capture by the alkaline wood ash (NCASI 1992). The degree of reduction is a function of the ratio of wood to coal or oil being burned. Co-firing of biomass in coal utility boilers has also been shown to lead to a reduction in NO_x emissions (NCASI 2003a). A 1% NO_x reduction is expected from baseline levels for every 1% co-firing percentage of biomass (Btu basis). The reduction in NO_x is brought about by several factors including reduced total fuel nitrogen, lower firing temperatures because of increased fuel moisture, and increased staging of the combustion process due to early volatiles burnout in the biomass fraction.

The burning of waste treatment plant (WTP) residuals in bark boilers at levels below about 10 to 15% of total heat input is not expected to lead to an increase in any of the criteria or criteria-related pollutants such as NO_x, SO_2, or VOC (NCASI 1993a), although a systematic study on this subject has not been conducted. A comparison of data on emissions of 48 organic compounds when burning wood residue and wood residue in combination with bleached kraft mill (BKM) WTP residuals (at <12 % heat input) in four wood-fired boilers showed no discernible impact on emissions of these organics when the residuals were co-fired with wood residue (NCASI 1993b). A similar comparison for metals emissions from two boilers burning wood residues and a combination of wood residues and BKM WTP residuals also showed no discernible impact due to the burning of WTP residuals (NCASI 1993b).

Table 10.2.2-1 EPA Emission Factors in lb/10^6 Btu Heat Input for Wood Combustion Boilers (EPA 2002, NCASI 2003b)

Compound	Mechanical Collector	Wet Scrubber	ESP	Electrified Gravel Bed Filter	Fabric Filter
PM	0.22 – 0.54	0.066	0.054	0.1	0.1
PM_{10}	0.2 – 0.49	0.065	0.04	0.074	0.074
$PM_{2.5}$	0.12 – 0.29	0.065	0.035	0.065	0.065
Condensible PM	0.017	0.017	0.017	0.017	0.017
	All Boiler Types except Fluidized Bed Combustors		**Fluidized Bed Combustors**		
	"Wet" Wood	"Dry" Wood			
NO_x	0.22	0.49	0.22/0.49		
CO	0.6	0.6	0.17		
Compound	**All Boiler and Control Types**				
SO_2	0.025				
HCl	0.00067				
TOC*	0.039				
VOC	0.017				
Acrolein	0.000078				
Acetaldehyde	0.00019				
Benzene	0.0033				
Formaldehyde	0.0013				
Phenol	0.000014				
Toluene	0.000029				
CO_2	195				
Methane	0.021				
N_2O	0.013				

*TOC – Total organic compounds; includes non-VOCs such as methane.

Table 10.2.2-2 Trace Metal Emissions
(EPA 1998a, 1998b, 1998c; NCASI 2003b)

	Natural Gas	No. 2 Fuel Oil	No. 6 Fuel Oil	Bit. Coal	Wood	Wood	Wood
	($lb/10^6$ scf)		($lb/10^3$ gal)	(lb/ton)	(median - $lb/10^{12}$ Btu)		
	Uncontrolled			Controlled	with MC	with WS	w ESP/FF
Sb	--	--	5.25E-03	1.8E-05	--	0.50	0.42
As	2.0E-04	4	1.32E-03	4.1E-04	1.3	3.7	0.4
Ba	4.4E-03	--	2.57E-03	--	4800	20	160
Be	<1.2E-05	3	2.78E-05	2.1E-05	0.75	0.55	0.40
Cd	1.1E-03	3	3.98E-04	5.1E-05	3.7	1.9	0.59
Cr	1.4E-03	3	8.45E-04	2.6E-04	17	6.6	0.52
Cr^{+6}	--	--	2.48E-04	7.9E-05	7.0	6.1	0.49
Co	8.4E-05	--	6.02E-03	1.0E-04	420	0.20	0.19
Pb	--	9	1.51E-03	4.2E-04	21	13	4.2
Mn	3.8E-04	6	3.00E-03	4.9E-04	1800	40	57
Hg	2.6E-04	3	1.13E-04	8.3E-05	1.6	0.66	0.62
Ni	2.1E-03	3	8.45E-02	2.8E-04	8.7	4.8	3.5
Se	<2.4E-05	15	6.83E-04	1.3E-03	5.6	2.8	3.3
Zn	2.9E-02	4	2.91E-02	--	220	280	41

MC – multiclone; WS – wet scrubber; ESP/FF – electrostatic precipitator or fabric filter

10.2.3 Other Non-Fossil Fuels

Pulp mill boilers capable of firing coal or wood often have the option to burn other solid fuels such tire chips, wastewater treatment plant residuals (sludge), rejected material from processing of old corrugated containers (OCC rejects), non-recyclable paper pellets, etc. The amount of these materials that can be burned in traditional spreader-stoker type boilers is relatively small, and co-firing them with wood and/or coal has only minimal effects on the emissions. Fluidized bed boilers, on the other hand, can accommodate much larger percentages of alternative solid fuels.

10.3 CONTROL OF STACK EMISSIONS

This section discusses the control of stack emissions from the various types of boilers and fuels discussed in Section 10.2.

10.3.1 Conventional Fossil Fuel-Fired Boilers

10.3.1.1 Natural Gas

Gas-fired boilers are usually not equipped with particulate collectors. SO_2 emissions depend on the sulfur content of the gas, which is typically negligible. NO_x emissions are dependent on the combustion temperature and the rate of cooling of the combustion products. There are several combustion modification techniques available to reduce the amount of NO_x formed in natural gas-fired boilers and turbines. The two most prevalent ones are flue gas recirculation (FGR) and low-NOx burners. FGR

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