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A Case History For Burning Dilute Noncondensible Gases In A Recovery Boiler: Decisions, Implementation, And Operations

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Abstract

The Alabama Pine Pulp Company pulp mill in Claiborne, Alabama was built approximately eight years ago. As a part of the project, both dilute and strong noncondensible gases, as well as stripper overhead gases, were collected and incinerated. At that time, it was decided to incinerate the dilute NCG in the recovery boiler. This is still to date one of the few installations incinerating NCG in the recovery boiler in North America. This paper discusses the considerations that affect the decision to inject these gases into the recovery boiler versus the other options available (e.g., power boiler, lime kiln, dedicated incinerator). Design considerations for safety and performance are also reviewed along with the actual operating history of the system and its effects on the recovery boiler.

Introduction

The Alabama Pine Pulp Co. pulp mill in Claiborne, Alabama was built approximately eight years ago. As a part of the original mill project, both dilute and strong noncondensible gases, as well as stripper overhead gases, were collected and incinerated. Both the strong noncondensible gases and the stripper overhead gases are burned in the lime kiln. The dilute noncondensible gases are burned in the mill's recovery boiler. The decision to burn the dilute gases in the recovery boiler was based on a number of considerations. These included volume and characteristics of these gases, the relative capital investments involved with the incineration in the recovery boiler vs. other potential options, and the technology that was developed to make the recovery boiler incineration option both safe and effective.

During the last seven years of operation of the noncondensible gas system at the Alabama Pine mill, the incineration of the dilute noncondensible gas in the recovery boiler has proven to be safe, reliable, and free of any operational or mechanical issues pertaining directly to the recovery boiler as the incineration point. For this reason, it is the mill's intention to continue burning these gases in the recovery boiler in the future. Furthermore, other mills can likewise consider this a viable option for the incineration of dilute noncondensible gases.

Characteristics of Kraft Pulp Mill Gases

Pulp mill noncondensible gas (NCG) can be generally divided into three categories. One category includes the low-volume high-concentration (LVHC) gases, often referred to as strong gas, and herein referred to as concentrated noncondensible gas (CNCG). Examples of the sources of this type of NCG are:

Turpentine Recovery

Blow Heat Recovery

Evaporator Hotwell / Aftercondenser

Foul Condensate Storage Tanks

Continuous Digester Relief

A special category of CNCG is overhead vapor from a foul condensate steam stripping system. This vapor is a mixture of methanol, water, and total reduced sulfur (TRS) compounds, and is usually referred to as Stripper Off Gas (SOG). Because of its special composition and properties, it is handled separately from the other CNCG.

Another category of NCG includes the high-volume low-concentration (HVLC) gases, often referred to as dilute gas, and herein referred to as dilute noncondensible gas (DNCG.) Examples of the sources of this type of NCG are:

Weak Black Liquor Storage Tanks

Knotter (Screen) Hoods

Brown Stock Washer Hoods

Brown Stock Washer Filtrate Tanks

Brown Stock Washer Intermediate Stock Chests

Brown Stock Washer Foam Tanks

Oxygen Delignification Blow Tanks

Oxygen Delignification Post O2 Washers

Oxygen Delignification Filtrate Tanks

Oxygen Delignification Interstage Pulp Storage Tanks

Decker Hoods and Filtrate Tanks

Chip Bin Relief Condensers*

Air Condensate Stripping*

** Special consideration must be given to these sources for its potential for containing significantly higher quantities of turpentine vapor and sulfides.*

Environmental regulations over the last 15 to 20 years have typically required that only the SOG and CNCG be collected and incinerated. However, with the recent promulgation of the Maximum Achievable Control Technology I (MACT I) Cluster Rules pertaining to the control of pulp mill emissions, both new mills and some mills with major expansions will be required to collect and control the HVLC gases as well upon start-up. Similar requirements will also apply to existing mill systems by the year 2006. The subject of this paper deals with DNCG only.

The flow rates and compositions of the DNCG vary with the source process design, the condition of the source equipment, and the wood being pulped. For this reason, the DNCG sources must be carefully studied prior to design. In general, however, the DNCG from kraft pulp mills can be characterized as wet air, contaminated with TRS compounds (e.g. hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide) methanol vapor, and, in some cases, turpentine vapor as well as other organic compounds. The concentration of these contaminants is typically below the lower flammable limit (LFL) for the actual mixtures of these compounds with air. The exact value of the mixture's LFL will depend on the relative amounts of the various contaminants, and will typically lie somewhere in the range of two to five (2-5) volume percent. Maintaining the concentration of these gases below the LFL is of significant value to the safety of the system, since gases with concentrations below the LFL will not sustain combustion without additional fuel.

At the Alabama Pine Pulp Co. pulp mill the following DNCG sources were collected for treatment by thermal oxidation (incineration):

Pressure Diffuser Feed Chute

Filtrate Tank

Thickener Hood & O2 Feed Chute

Brown Stock Filtrate Tank

Kamyr Blow Tank

Chip Bin Relief Condenser

Figure 1. is a simplified schematic of the Alabama Pine Pulp Co.'s DNCG gas collection and incineration system. The system collects the vents from the various sources, uses fans to motivate the gases, and injects the gases into the secondary air duct going to the recovery boiler. Additional information about this system can be found in this paper under the heading of "Safety and Operational Considerations."

Incineration Options For Dilute Noncondensible Gases

A number of options are available for the incineration of the DNCG in a kraft pulp mill. These options include a recovery boiler, a power boiler, a dedicated waste gas incinerator, a lime kiln, and a regenerative thermal oxidizer (RTO). The viability of each of these options depends on site-specific considerations, which include the following:

- The volume of the DNCG to be incinerated.
- The air flow requirements, relative to the DNCG flow, for the incineration point under consideration.
- The regulatory permitting requirements for the incineration point under consideration.
- The existence of stack monitoring equipment for SO2 and/or TRS on the incineration point under consideration.
- The existence of flue gas scrubbing equipment for SO2 on the incineration point under consideration.
- The availability of high-Btu-value waste gas (especially SOG) to provide the primary fuel for a dedicated waste gas incinerator.
- The physical proximity of the various candidate incineration points to the majority of the DNCG sources.
- The availability of a suitable location for the injection of DNCG gases into the incineration point under consideration.

- The incineration temperature and residence time available in the incineration point under consideration.
- Past experience with the incineration of waste gases in one or more of the candidate incineration points.
- The operational availability factor for each of the candidate incineration points.
- The cost of oil or natural gas to be used as either primary or auxiliary fuel for a dedicated waste gas incineration system.
- The potential for corrosion in existing air systems and/or leakage of malodorous and noxious gases to the surrounding mill environment.
- The presence of turpentine vapors in the DNCG.

Comparison of Various Incineration Options With Burning Dilute Noncondensible Gas In The Recovery Boiler

A comparison of the recovery boiler option for DNCG incineration with other candidate incineration points should take into account the considerations listed above for the specific site. Several typical guidelines can be used to facilitate this evaluation.

1. The volume of the DNCG to be incinerated is typically on the order of 10,000 to 40,000 actual cubic meters per hour, or even more, depending on the types of sources being collected and the age and condition of the source equipment. This flow rate is on the order of magnitude of the total forced draft air flow requirement for most lime kilns and many smaller power boilers, and in many cases may even exceed that requirement. For this reason, DNCG is not typically burned in lime kilns, unless the DNCG system is dedicated to only one or a few sources. On the other hand, larger boilers, including recovery boilers, may have forced air flow requirements that are five or ten times the flow of the DNCG, and they are therefore a much better "fit" for the incineration of these gases. A dedicated waste gas incinerator or a RTO can be sized to handle even the highest DNCG flows.
2. The regulatory permitting requirements for fired equipment with stack emissions often varies from state to state and even from mill site to mill site. In some situations, the permit granted to existing equipment may allow the substitution of DNCG for part of the forced draft air, without a re-permitting process. When this is the case, it would favor the utilization of a recovery boiler or other large boiler for burning the DNCG over new dedicated equipment (such as an incinerator or a RTO), which would require an entirely new permit.
3. Many existing power boilers that use low-sulfur fuels do not have continuous emission monitoring systems (CEMS) for their flue gases. The recovery boiler, on the other hand, normally burns concentrated black liquor, which contains sulfur compounds including TRS. For this reason, the recovery boiler, which normally captures most sulfur compounds in the smelt as useable product, typically has a CEMS to monitor TRS. It may also have a CEMS for S02 as well, although only sometimes, since the boiler SO2 emissions are quite low. This favors the recovery boiler over some power boilers for burning of DNCG, since it may eliminate the need for additional stack monitoring systems. However, it is not an advantage when comparing the recovery boiler to dedicated waste gas incineration systems, which typically provide effective incineration and flue gas scrubbing through the demonstrated control of furnace temperature and residence time, scrubbing media pH, and scrubbing media flow, without the requirement of an installed CEMS.

4. Again, many existing power boilers that use low-sulfur fuels do not have flue gas scrubbing equipment for the removal of SO_2 emissions. The recovery boiler, which normally oxidizes certain sulfur compounds contained in the black liquor to SO_2, typically does not require such equipment, due to the subsequent buffering reactions in the recovery boiler. The burning of DNCG in the recovery boiler does not increase the generation of SO_2 in the boiler furnace to the degree that the specified level of SO_2 for the boiler's stack emissions permit will be exceeded. This is because the mass of sulfur as TRS compounds in the DNCG is very small in comparison with those sulfur compounds in the black liquor that will oxidize to SO_2. This characteristic of the recovery boiler eliminates the need for additional SO_2 scrubbing equipment which might be required for DNCG in a power boiler, in a waste gas incinerator, or in a RTO.

5. Since the DNCG simply replaces part of the forced draft air that is required by the recovery boiler, the additional fuel consumption required by dedicated incineration equipment, such as a waste gas incinerator or a RTO, is avoided. However, in the case of a waste gas incinerator, this advantage may be only slight, if a high-Btu-value waste gas stream (i.e., SOG) is available for combustion in the incinerator. Those mills with properly designed and operated foul condensate steam strippers will have a methanol-rich off-gas stream that can be used to drastically reduce the consumption of auxiliary fuel, such as oil or natural gas, in the incinerator. The use of SOG as a fuel source for a RTO raises concerns, due to possible difficulties in temperature control of the RTO packed beds.

6. The large majority of the DNCG sources that are to be collected under the MACT I Cluster Rules are physically located either in the pulp mill or in the bleach plant (O_2 delignification). Weak liquor tanks, whose collection is required under the Cluster Rules only if they are part of a "new" pulping line, are the only DNCG sources (named in the Cluster Rules) that typically might be located in close proximity of the recovery boiler. The same general statement would apply less exactly to the power boilers. Dedicated incineration systems, such as an incinerator or a RTO, may be located much closer to the majority of the sources. This could produce a savings in the installed cost of the DNCG system that would partially offset the cost of the new incinerator or new RTO. Furthermore, by reducing the length of the collection header, it is possible to reduce the horsepower requirements for the DNCG collection fan. The physical layout of the plant will always be an important consideration.

7. Since the DNCG flow rates are typically quite high, and the resulting DNCG pipelines to the incineration point are often quite large (on the order of 600 mm to 900 mm), a suitable location that is physically accessible for the injection of the DNCG into the incineration point must be identified before the final decision on the incineration point can be made. In this regard, there is no generic advantage for the recovery boiler over a power boiler or vice versa. It is typically good practice to inject the gases into the tubular air heater inlet or outlet for some power boiler designs, and into a secondary air duct downstream of the air preheater for the recovery boiler. The individual boiler design must be studied with respect to good mixing of the DNCG with the balance of the boiler air, the avoidance of low points where DNCG and/or turpentine-laden condensates could accumulate, and the physical feasibility of the pipe routing and the DNCG system equipment installation.

8. If a recovery boiler, a power boiler, or a lime kiln is used as the point of incineration, then MACT I only requires that the waste gases be injected into the burning zone. On the other hand, dedicated waste gas incineration systems, whether an incinerator or a RTO, must be designed to meet the minimum residence time requirement of 3/4 second at 870°C.

9. In some cases, a given mill site will already have successful experience with the incineration of waste gases in a particular incineration point. Other considerations being equal or nearly so, this experience of the mill's operations, maintenance, and engineering staff may provide a valid justification for selection of a similar incineration point for the burning of the additional DNCG. This was the case at the Alabama Pine Pulp Co. mill, as mentioned below.

10. Generally speaking, recovery boilers have high availability factors and, if the recovery boiler is not in service, then the remainder of the mill will also shut down within a short period of time. This is an advantage over lime kilns, which are subject to more frequent interruptions in operation. Recovery boiler operations tend to be steady, unlike some power boilers whose rate of firing may fluctuate somewhat with steam demand. These relative advantages, however, are not enjoyed over dedicated waste gas incinerators, which are known to achieve steady operation and 98% availability.

11. The introduction of DNCG into the air supply systems of either recovery boilers or power boilers often raises the concern of potential corrosion in the existing air ductwork or windboxes. It can also raise concerns regarding the leakage of malodorous and noxious gases from corroded ductwork and leaky joints into the surrounding mill environment. These concerns can be effectively addressed by ensuring that the gases are both dry and superheated before their introduction into the boiler air system, and by verifying and maintaining the mechanical integrity of the air ductwork and its joint gasketing or sealant. Another approach for dealing with these concerns is to inject the DNCG directly into the boiler furnace, similar to the waste gas injection that is often done for dedicated waste gas incinerators and lime kilns. One disadvantage to this approach is the investment required for a sizable boiler tube wall modification. Another disadvantage is that the beneficial dilution, obtained by combining the DNCG with other boiler air, is lost when the DNCG is injected directly into the furnace.

12. The potential for high levels of turpentine vapors in the DNCG of softwood mills can raise safety concerns due to that vapor's high flame propagation speed and low flammable limit (less than one percent). In a fundamental sense, the need to eliminate high concentrations of turpentine vapor in the DNCG is a safety requirement regardless of which incineration option is selected. In a practical sense, however, the size of the DNCG system and the actual location of each viable incineration option may affect the determination of how to deal most effectively with DNCG from sources that present a potential for high turpentine concentrations (for example, chip bins and air stripping systems). For example, in a smaller DNCG system the chip bin gas would not be diluted so much when combined with gases from the other sources. It might be advisable under such circumstances to collect and incinerate the chip bin gas separately from the other DNCG. In this case, it is quite conceivable that the chip bin gas might be burned in one incineration point (close to the chip bin), while the other DNCG might be burned in another incineration point (located more conveniently with respect to the rest of the DNCG sources).

Safety and Operational Considerations

In order to obtain the safe and reliable incineration of the DNCG in the recovery boiler, a number of safety and operational considerations are necessary. Some of these considerations would be just as relevant for the burning of DNCG in any other incineration point as well. However, in the case of recovery boiler incineration, special consideration is given to the elimination of moisture from the waste gas stream and the introduction of DNCG to the incineration point as a superheated gas without any entrained liquids. This minimizes any concern that the DNCG system could become a source of corrosion in existing air supply systems or of liquid coming into contact with the smelt bed in the boiler. The following list is intended to provide the reader with generic system design guidelines. However, any actual DNCG incineration system will require individualized and detailed scrutiny, and possible additions to this list. In particular, careful planning of the DNCG gas pipeline routing must be done to ensure proper sloping of the lines, as well as the elimination of low points in the piping (or the proper drainage of low points when these are unavoidable).

1. As described above in the section "Characteristics of Kraft Pulp Mill Gases," the DNCG sources are those whose combustibles concentrations can be maintained consistently below the LFL. Therefore, the collection of strong (CNCG) sources into the DNCG system must be avoided, since the inclusion of even one strong source creates the potential for pushing the combustibles concentration of the combined DNCG gases above the LFL.

2. The gas lines must be sized to provide safe line velocities above the flame propagation speeds of methanol and TRS compounds. This is especially important for the combined gas line going to the incineration point. A low gas flow interlock must be provided for this line to ensure that the gases are vented if this safe line velocity is not maintained.

3. Ambient flow make-up air must be provided on flow control both to ensure a minimum safe line velocity and to maintain a steady flow of gas to the incineration point. This allows the DNCG system to provide a consistent contribution of air to the boiler, even when the system experiences variation in gas flows from one or more of the sources.

4. A flame arrester provided in the gas line just upstream of where this line combines with the forced draft air to the boiler will protect the DNCG system equipment from damage in the unlikely event of a source of ignition combined with a gas combustibles concentration above the LFL. A temperature transmitter, located between the flame arrester and the gas injection point, provides a high temperature interlock which will cause the DNCG system to vent its gases to atmosphere in the unlikely event that burning at this point were to occur.

5. Entrainment separators are included in the system both to serve as low point drains and to eliminate liquid droplets entrained in the gas stream. The condensate drain lines from the entrainment separators as well as any other low point drains are monitored with level switches or transmitters. This instrumentation provides high level interlocks which vent the DNCG system gases whenever the liquids are not draining properly. These provisions are especially important for incineration of the DNCG in the recovery boiler, since the introduction of liquid water to the boiler furnace must be strictly avoided.

6. A gas heater is included in the system to superheat the DNCG before it is injected into the forced draft air stream going to the boiler. This accomplishes the same preheating that is required for the forced draft air for which the DNCG is substituted. It also ensures that the DNCG is free of liquid moisture, by preheating the gas to a temperature well above the dewpoint. In addition to addressing the safety of the installation, the preheating prevents the corrosion that would otherwise occur, particularly in the boiler's air supply system. The gas heater may be of either shell-and-tube or steam-coil design. A low temperature interlock for the DNCG at the point of injection into the boiler will vent the DNCG until a minimum safe gas heater outlet temperature is obtained. The DNCG system vent at the boiler is located

downstream of the gas heater. This allows the gas temperature to be re-established while venting the DNCG.

7. A rupture disc, provided in the combined DNCG gas line going to the incineration point, will protect the DNCG system equipment from damage in the unlikely event of high pressure due to a fire in the DNCG line. The system also includes a pressure switch located near the rupture disc with an interlocked high pressure alarm that will vent the DNCG whenever the gas line pressure near the rupture disc approaches the burst pressure of the disc.

8. A combustibility meter, used to detect the percent of LFL in the DNCG can be used to alarm at a given concentration, or can even provide an interlock that vents the system when the combustibles concentration in the DNCG becomes too high. In order for such an interlock to be effective, it is necessary to install the meter(s) near the source or sources which may be expected to experience high combustibles concentrations, and then vent the combined system DNCG near the incineration point on high percent LFL.

   These meters have been used successfully at a number of mills. They do require regular calibration and maintenance in order to obtain reliable results and to avoid nuisance trips. Assuming that they receive the appropriate attention, they can be a useful safeguard. However, they should not be used as substitutes for a design that eliminates high concentrations of combustibles in the DNCG. In a properly designed DNCG system, which incorporates the other safety considerations mentioned herein, combustibility meters can be omitted while still maintaining safe DNCG collection and incineration.

9. Chip bin vents present the potential for high concentrations of combustibles, including (in softwood mills) turpentine vapors. While it is true that the chip bin's DNCG combustibles are diluted significantly when combined with gas from other DNCG sources, additional system safeguards are necessary in order to avoid combustibles concentrations in excess of the LFL in the combined DNCG going to the incineration point. It is therefore important that the operation of the chip bin, as well as the handling of its vent gas, be designed to eliminate high combustibles concentrations due to vapor "blow-throughs" or other chip bin upsets. This will require stable operational levels and temperatures in the chip bin, an adequately-sized chip bin relief condenser, and an interlock that vents the chip bin source to the atmosphere on high temperature at the chip bin relief condenser vent.

   The design of the chip bin itself, as well as the control strategy for the presteaming of chips in the bin, will also affect the determination of safeguards that are required to maintain low concentrations of combustibles in the bin's vent gas.

10. The following list is a summary of the typical interlocked permissives that must be satisfied in order to burn DNCG in the recovery boiler.

    - Recovery boiler ready to receive DNCG. (This is typically a combination of several boiler conditions; for example, a certain minimum steam production, air supply fans running, and boiler flame safety system in normal operational status.)
    - DNCG flow not too low at the boiler.
    - DNCG temperature not too high at the boiler.
    - DNCG temperature not too low at the boiler.
    - DNCG pressure not too high anywhere in the system.
    - Foul condensate level not too high in condensate drains and/or condensate collection tank(s) anywhere near the boiler.
    - DNCG blower(s) running.

The venting of gases from the recovery boiler may, under certain conditions, be followed by transfer of DNCG to a secondary or back-up incineration point. However, given the high availability factors of most recovery boilers, back-up incineration points for DNCG may not be required for Kraft pulp mills in most states.

Alabama Pine's Experience

The Alabama Pine Pulp Co. pulp mill in Claiborne, Alabama was built approximately eight years ago. As part of the project, both CNCG and DNCG, as well as SOG, were collected and incinerated. It was decided by the project management to burn the DNCG in the new recovery boiler that was being built for the project.

The design base volume of DNCG to be collected was approximately 12,000 actual cubic meters per hour. This flow was considered too large for the lime kiln (where the CNCG and the SOG are incinerated). If the power boiler had been used for incineration of the DNCG, its stack would then have become another point source for the monitoring of TRS emissions. The recovery boiler, which normally captures most sulfur compounds in the smelt as useable product, was already set up to do this monitoring with a CEMS for TRS emissions. The fact that the steam production rate of the power boiler fluctuates with steam demand was also a consideration, when compared to the recovery boiler which normally operates at a steady rate. It was estimated that the additional sulfur loading from the DNCG would be very small in comparison with the sulfur being burned with the liquor in the recovery boiler, and that it would not cause a significant increase in the potential for SO2 emission from its stack. The option of a dedicated waste gas incinerator for the DNCG was discarded on the basis of the incinerator's capital project cost and potential fuel requirement. The possibility of using the DNCG as a source of combustion air and cooling air for an incinerator that would utilize SOG as a primary fuel, thereby minimizing the auxiliary fuel requirement, was not explored at the time. An important consideration for the project management in this matter was the fact that the Alabama River Pulp Co., a parallel pulp mill located at the same site, already had experience with the incineration of DNCG from that mill's brown stock washers in a recovery boiler. An RTO, which also would have added considerable capital cost to the project, was not considered, since that technology had not been demonstrated for the treatment of kraft pulp mill gases.

Alabama Pine Pulp Co. contracted with A. H. Lundberg Associates, Inc. for the supply of equipment and system engineering for the new CNCG system, the new DNCG system, and the new SOG system. The DNCG system was designed to collect the gases from seven new sources, transport them to the new recovery boiler with centrifugal fans as the motivating equipment, superheat the gases to 149°C in a steam coil air heater, and inject the gases into one of the recovery boiler's secondary air supply ducts. The injection point is located in a secondary air duct and downstream of the air preheater on the discharge side of one of the secondary air supply fans. From that point on, the DNCG is diluted with the forced draft air.

The safety and operational considerations listed in the earlier section of this paper were applied for this system, with special care given to any aspect of the system design that could prevent the introduction of liquid water into the boiler furnace. The DNCG system started up in December, 1991. The incineration of the DNCG in the recovery boiler since that time has continued in a safe and reliable fashion. The mill has detected no process, operating, or maintenance issues with the recovery boiler that might be attributable to the incineration of these gases in the boiler. Alabama Pine has burned DNCG in their recovery boiler practically since the boiler's start-up, and therefore "before and after" type corrosion data are unavailable. However, furnace tube wall corrosion has not exceeded typically expected rates. No discernible change in TRS emissions from the boiler stack is observed when the DNCG are introduced. A calculated estimate of the amount of sulfur added to the boiler furnace with the DNCG is 8-10 kg/hr. It is expected that most, if not all of this sulfur is captured in the smelt, and that the increase in SO2 emission due to burning of DNCG is negligible.

Summary

With the recent promulgation of the MACT I Cluster Rules pertaining to the control of pulp mill emissions, both new mills and some mills with major expansions will be required to collect and control the HVLC gases generated in their processes upon start-up. Similar requirements will also apply to existing mill systems by the year 2006. The options available for the incineration of HVLC NCGs include a recovery boiler, a power boiler, a dedicated waste gas incinerator, a lime kiln (for smaller systems only) and a regenerative thermal oxidizer (RTO). The comparison of the recovery boiler option for HVLC gas incineration with other candidate incineration points should take into account a number of site-specific considerations, which include the following:

- The volume of the DNCG to be incinerated.
- The air flow requirements, relative to the DNCG flow, for the incineration point under consideration.
- The regulatory permitting requirements for the incineration point under consideration.
- The existence of stack monitoring equipment for SO2 and/or TRS on the incineration point under consideration.
- The existence of flue gas scrubbing equipment for SO2 on the incineration point under consideration.
- The availability of high-Btu-value waste gas (especially SOG) to provide the primary fuel for a dedicated waste gas incinerator.
- The physical proximity of the various candidate incineration points to the majority of the DNCG sources.
- The availability of a suitable location for the injection of DNCG gases into the incineration point under consideration.
- The incineration temperature and residence time available in the incineration point under consideration.

- Past experience with the incineration of waste gases in one or more of the candidate incineration points.
- The operational availability factor for each of the candidate incineration points.
- The cost of oil or natural gas to be used as either primary or auxiliary fuel for a dedicated waste gas incineration system.
- The potential for corrosion in existing air systems and/or leakage of malodorous and noxious gases to the surrounding mill environment.
- The presence of turpentine vapors in the DNCG.

When the appropriate safety and operational considerations are applied to the design of the HVLC system, these gases can be treated safely and effectively in the recovery boiler. Based on the experience of Alabama Pine Pulp Co. since 1991, we can conclude that the incineration of HVLC gases in recovery boilers is both safe and economical in comparison with other treatment options. Alabama Pine has detected no process, operating, or maintenance issues with the recovery boiler that might be attributable to the incineration of these gases in the boiler.

References

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