Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Background Report Reference

AP-42 Section Number: 9.10.1.1

Background Chapter: 2

Reference Number: 4

Title: Written Communication for P. Wesson, Golder Associates, Gainesville, FL to D. Safriet

U.S. EPA

U.S. EPA

March 1997

Rec'd 3/25 [illegible]

Golder Associates Inc.

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Golder Associates

AP-42 Section 9.10.1.1
Reference 4
Report Sect.
Reference

March 20, 1997

Mr. Dallas Safriet
U.S. EPA
EMAD/EFIG, MD-14
79 TW Alexander Drive
Research Triangle Park, NC 27709

Dear Mr. Safriet:

Golder Associates Inc. (Golder) has worked with the Florida sugar industry on various regulatory and permitting issues for over 15 years. Accordingly, Golder has been asked to assist in coordinating the industry's comments on the draft AP-42 Section 9.10.1.1, Sugarcane Processing. The comments put forth in this letter reflect those received from six of the seven sugar mills in Florida and Golder's own experience in the industry. Comments are presented below as they relate to individual sections of the draft AP-42 background document and the proposed AP-42 Sugarcane Processing section. Comments on the background document are identified according to section, and comments on the associated AP-42 section are identified in parentheses. Suggested wording for incorporating these comments into the final AP-42 section are included at the end of each comment section.

2.0 Industry Description (9.10.1.1.1 General)

Bagasse, the fibrous material retained after the cane has been milled, and bagasse residue, bagasse fibers that have been used in the furfural production process, are <u>not</u> considered by the industry to be a byproduct or solid waste of sugarcane processing. They are considered to be renewable resources as described in the attached letter from the Florida Department of Environmental Protection (FDEP) to the Office of Air Quality Planning and Standards (OAQPS) dated January 29, 1997. The distinction between useable product and byproduct or solid waste is an important one where regulations involving the combustion of bagasse and bagasse residue are concerned. It is important that this distinction be noted in the AP-42 Section. Suggested wording is presented below:

> ... as a raw material for production of chemicals. Bagasse and bagasse residue from chemical production are categorized by the sugar industry and government regulators as a co-product of cane sugar production. Bagasse and bagasse residue are primarily used as a fuel source for the boilers in the generation of process steam. Thus, bagasse is a renewable resource. Dried filtercake ...

2.1 Industry Characterization

More recent values for production data presented in this section are available from the 1996/97 biennial publication entitled *Gilmore Sugar Manual* published by Sugar Publications in North Dakota. Also included in this manual are technical details on production and operations for each sugar mill in the United States. This may be of some help in revising/editing the industry writeup in the AP-42 Section. More recent data from the *Gilmore Sugar Manual* are presented below:

> ...Puerto Rico also produces sugarcane. For 1995, Florida harvested 437,000 acres with a yield of about 15.12 million tons of sugarcane. For other states, Louisiana

> produces about 10.24 million tons, followed by Hawaii with about 4.07 million tons and Texas with about 1.36 million tons. No data were...

2.2 Process Description (9.10.1.1.2 Process Description)
2.2.1 Harvesting (9.10.1.1.2.1 Raw Sugar Production): In Florida, large cane crop growers predominantly use mechanical harvesting equipment to cut the cane. In addition, cane tops and leaves are usually removed during the harvesting of the cane.

> Hand cutting is the most common harvesting method throughout the world but some locations (e.g., Florida, Louisiana, and Hawaii) have used mechanical harvesters for several years. After cutting...

2.2.2 Raw Sugar Production (9.10.1.1.2.1 Raw Sugar Production): The flow diagrams presented for raw and refined sugar production correctly show the basic processes involved in production. However, it should be noted that process flows at many of the mills may be different than shown in Figures 2-1 and 2-2 (Figures 9.10.1.1-1 and 9.10.1.1-2) due to various technical differences and improvements associated with individual mills. On Figure 2-1 (Figure 9.10.1.1-1), you indicate that seeding of the vacuum pans is performed by using sugar crystals from the process. Instead, some Florida mills use isopropyl alcohol, a volatile organic compound (VOC), and ground sugar or other similar seeding agent in place of crystals from the process.

On Figure 2-1 (Figure 9.10.1.1-1), VOCs are shown being emitted from the evaporators. A more likely source of VOC emissions is the first clarifier where lime and soluble phosphate are added. However, VOC emissions from sugar milling operations are thought to be minimal, even insignificant, in comparison to VOC emissions from other sources at the facility such as the boilers. Further, to the best of our knowledge, measurements of VOC emissions from the sugar milling processes have never been performed nor has there ever been a need to perform these measurements. Thus, VOC emissions from the evaporators and the clarifiers should be removed. The only VOC sources on Figure 2-1 (Figure 9.10.1.1-1) should be the boilers and the vacuum pans.

2.2.3 Refined Sugar Production (9.10.1.1.2.2 Refined Sugar Production): On Figure 2-2 (Figure 9.10.1.1-2), VOC emission points shown on the clarifier and the evaporators should be removed because the emissions are thought to be insignificant in comparison to other sources in the process flow. The water wash after the centrifugal is typically applied within the centrifugal prior to discharge into the melter. The process block now labeled *water wash* would probably be better described as a pre-melter as shown in references such as the *Cane Sugar Handbook*, J.C.P. Chen and C. Chou. A block for refined sugar drying and cooling should also be inserted between the last water wash and the distribution bins. Particulate matter (PM) is emitted from the drying and cooling processes and should be indicated on the flow diagram.

It would be worth mentioning that a relatively new method of sugar drying and cooling involves the use of a fluidized bed dryer/cooler. Both drying and cooling are performed in one unit through the use of high velocity air injected between the sugar particles. This suspends the particles in a *bed* of air that dries (with heated air) and cools (with cooler air) the sugar. Consequently, PM emissions from a fluidized bed unit are less than from conventional rotary drying systems. In a fluidized bed, fewer sugar particles are broken down compared to rotary dryers that turn the sugar back onto itself. The rotary drying system causes an abrasive effect that creates more small airborne sugar dust particles than the fluidized bed system. The fluidized bed system is usually more expensive than a rotary drying system, but it can yield benefits such as lower operation and maintenance costs that outweigh the difference in capital costs associated with fluidized bed units.

2.3 Emissions and 2.4 Emission Control Technology (9.10.1.1.3 Emissions and Controls)
The following comments and observations reflect our experience from permitting multiple sugar refining processes. PM is the main pollutant of concern for raw and refined sugar processing. In most instances however, PM emissions are so minor that visible emission (VE) testing in lieu of particulate stack testing is adequate to ensure compliance with air emission regulations. Nonetheless, theoretical estimates of PM emissions from various sugar processes may be made based on similar engineering assumptions presented below.

When wet rotoclones are used to control/reclaim sugar from the refining process, the only data available on control efficiencies may be from the vendor. This information is usually dependent on the sugar dust particle size distribution generated in the drying and handling processes. Sugar dust generated from fluidized bed drying operations prior to being vented to control devices is conservatively estimated to be 1.5 percent of the refined sugar output based on data from the fluidized bed dryer/cooler manufacturers. For rotary drying operations, sugar dust generation is conservatively estimated at approximately 3.5 percent of the total refined sugar output. However, most of the dust generated is large in comparison to airborne dust and therefore is easily captured by the control equipment. Knowing the dust particle size distribution is extremely important because it will give a good idea of the size and number of particles that are captured and those that are emitted.

When wet cyclones are used to control sugar PM emissions and when vendor data are not available, as is the case with many older refineries, emissions can be estimated based on design equations for dry cyclones. This method requires a knowledge of equipment dimensions and air flow rates and the use of standard design equations by Shepherd and Lapple, as presented in Cooper and Alley's book *Air Pollution Control: A Design Approach.* Since these equations are valid for dry cyclones, an additional control efficiency based on actual equipment design may be assumed to account for the removal efficiency associated with using water spray nozzles inside the cyclone to provide wet collection.

Instead of employing wet collection systems to control PM emissions from refined sugar drying and handling operations, a more efficient method of sugar collection and reclamation is through the use of baghouses. Usually pulse jet baghouses are used to control fugitive emissions from sugar handling and also from point source emissions such as fluidized bed drying and cooling. The use of pulse jet baghouses increases control/collection efficiency and allows the dry sugar to be recycled back to the process without stopping the process to clean and maintain the control equipment.

When baghouses are used to control sugar PM emissions, emission estimates can be made by utilizing design equations as long as the sugar dust particle distribution, the equipment specifications, and the air flow rates are known. As mentioned previously, most PM emissions from raw and refined sugar processes are minimal and, as a result, VE testing has been predominantly used in Florida to satisfy compliance with air regulations. Typically, VEs of 20 percent are required for PM sources that do not have a baghouse controlling emissions and 5 percent for those with baghouses.

Boiler stack emissions in Florida are typically controlled by cyclones followed by wet scrubbers or simply wet scrubbers having an effective PM removal rate of up to 98 percent. Unlike cyclones, most wet scrubbers also control sulfur dioxide (SO_2) emissions at a 50 to 90 percent removal rate without the aid of chemical pH control. Additionally, sugar mill boilers can be controlled by electrostatic precipitators (ESPs), but EPSs provide only particulate emission control.

Conclusion
This document contains the comments of many people involved in the Florida sugar industry. We hope, you will be able to use these suggestions to assist you in final development of the AP-42 Sugar Processing section. Thank you for the opportunity to present these comments.

Sincerely,

Paul J. Wesson
Environmental Engineer

Attachment
PJW/vjp

cc: David Buff, P.E. , Golder Assoc.
Don Griffin, U.S. Sugar Corp.
Matt Capone, Okeelanta Corp.
Jorge Cabrera, Osceola Farms Co.
Hector Cardentey, Atlantic Sugar Assoc.
Jose Alvarez, Sugar Cane Growers Cooperative
Dr. David Cooper, University of Central Florida
Peter Oppenheimer, Bryan Cave LLP
William Tarr, Flo-Sun, Inc.
File (2)

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Department of
Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

January 29, 1997

Mr. Fred Porter
Combustion Group (MD-13)
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

Re: Regulation of Bagasse as a Fuel

Dear Mr. Porter:

The Department of Environmental Protection's Bureau of Air Regulation (BAR) is providing you with information on how bagasse is regulated as a fuel in the State of Florida. BAR understands that the distinction between fuel and solid waste is essential to the applicability of various air pollution control rules being developed by the U.S. Environmental Protection Agency in the Industrial Combustion Coordinated Rulemaking (ICCR). It is important for EPA to properly classify bagasse in the ICCR to ensure that the regulatory framework established by Florida DEP to regulate carbonaceous fuels will not be disrupted, and to avoid misleading the public as to the nature of this renewable fuel resource or the function and character of the stream generating units in which bagasse is burned as fuel. It will also enable DEP and other State and local environmental agencies to afford consistency in their regulatory treatment of bagasse that is burned to produce energy.

Bagasse is the matted cellulose fiber that is co-produced with sugar juice when sugar cane is processed in sugar mills. Although bagasse is sold for use as a raw material in the manufacture of a variety of products, its principal use is as fuel. In fact, bagasse has been the primary source of fuel used to power sugar mills for years, and is increasingly being used to produce surplus electric power for sale to the grid. Bagasse has long been established as a renewable fuel resource in Florida.

Since shortly after the passage of the 1970 federal Clean Air Act, BAR (and its predecessor entities) have regulated bagasse as a carbonaceous fuel, not as a solid waste, and bagasse burners as boilers, not incinerators. DEP has promulgated regulations that classify bagasse as a fuel and bagasse-burners as boilers, not incinerators. Carbonaceous fuel is defined as "solid materials composed primarily of vegetative matter."

Carbonaceous fuel burning equipment is defined as "a firebox, furnace or combustion device which burns carbonaceous and fossil fuels for the primary purpose of producing steam or to heat other liquids or gases."

Since the early 1970's, DEP has regulated visible emissions and particulate matter emissions from both new and existing bagasse boilers under a rule governing carbonaceous fuel burning equipment. This rule was approved by EPA and adopted into the State Implementation Plan (SIP) in 1974. More recently, the Department promulgated NO_x and VOC RACT standards for carbonaceous fuel burning equipment located in ozone nonattainment areas that have since become attainment/maintenance areas. The NO_x and VOC RACT standards have been approved by EPA and adopted into the Florida SIP.

Under Florida law, solid waste includes garbage, refuse, yard trash, clean debris, white goods, special wastes, ashes, sludge, or other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from domestic, industrial, commercial, mining, agricultural or governmental operations. We have never interpreted this definition to include bagasse, because bagasse is a renewable fuel rather than a discarded material. Additionally, boilers that burn bagasse are excluded from Florida's solid waste management regulations, which are administered by the Division of Waste Management. This exclusion reflects the State's long-standing view that bagasse is a fuel, not a solid waste, and that bagasse burners are boilers, not incinerators.

We appreciate your consideration of this information and would be happy to answer any questions or provide any additional information on this issue that EPA needs to confirm that bagasse is not a solid waste as you move forward with the ICCR process. Please do not hesitate to contact me directly at 904/488-1344, or Michael W. Hewett at 904/488-0114, who is a member of the ICCR boiler workgroup.

Sincerely,

C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

CHF/ch

cc: Michael W. Hewett, DARM
David Knowles, South District
Robert F. Van Voorhees