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Title:	Written communication from Brian Shrager, Midwest Research Institute, Cary, NC, to Dallas Safriet, U. S. Environmental Protection Agency, Research Triangle Park, NC, May 5, 1994.

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MRI

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Date: May 5, 1994

Subject: Site Visit--Stroh Brewery Company, Winston Salem, NC
Review and Update of AP-42 Chapter 6, Food and Agriculture, EPA Contract 68-D2-0159; MRI Project 3605-99

From: Brian Shrager

To: Dallas Safriet
EPA/EIB/EFMS (MD-14)
U. S. Environmental Protection Agency
Research Triangle Park, N.C. 27711

I. Purpose

The purpose of the visit was to familiarize the project team with brewery operations in order to facilitate the development of the new AP-42 section addressing beer brewing.

II. Place and Date

Stroh Brewery Company
U.S. Route 52
Winston Salem, North Carolina

Date: September 24, 1993

III. Attendees

Stroh Brewery Company (Stroh)

Greg Miller, Manager-Environmental Affairs
Joe Kwolkoski, Plant Engineer
Paul Heppler, Assistant Engineer

U.S. Environmental Protection Agency (EPA)

Dallas Safriet, EIB
Ron Ryan, EIB

Midwest Research Institute (MRI)

Roy Neulicht
Brian Shrager

IV. Discussion

The group began the trip with a brief discussion of the plant operations as well as Stroh operations throughout the United States. The following are some of the key points of the discussion:

1. Malting operations are not performed at this plant.

2. The plant uses corn syrup instead of corn in the brewing process. This eliminates corn cookers from the brewing process.

3. In addition to the normal can, bottle, and keg filling lines, the plant has two sterile filling lines. These lines are located within the filling area of the facility, but each line is located in plastic sheeting enclosures, which are maintained under positive air pressure during operation.

4. The plant produces about 3.9 million barrels of beer per year, and has a capacity of approximately 5.0 million barrels per year. The plant is relatively small compared to the Coors plant (20 million barrels per year) that furnished the filling operations emission data to EPA. There are 31 U.S. gallons in a barrel.

5. Mr. Miller indicated that the largest ethanol emission source at the plant is the alcohol stripper, which is used to decrease the ethanol content from waste beer. The alcohol stripper is a submerged burner which heats the liquid waste stream, resulting in evaporation of the ethanol. The alcohol stripper is needed to reduce the biological oxygen demand (BOD) load on the city sewer system. The alcohol stripper removes about 65 percent of the alcohol from the liquid stream. The source emits about 300 tons of ethanol per year. Mr. Miller indicated that the plant is planning to replace the alcohol stripper with an ethanol recovery system in the next year.

6. Mr. Miller suggested that filler emission factors be based on beer spillage rather than production, because the only ethanol emissions from filling operations come from beer loss. Stroh is concerned about the use of the Coors data for filling operations because Coors filling operations are not representative of the industry.

Following the discussion, the group toured the facility. Figure 1 shows a process flow diagram for the plant. Malted barley is shipped to the plant by rail, and is pneumatically conveyed to 20 grain storage silos. Particulate matter (PM) emissions from the grain unloading process are controlled by filter receivers, which are cyclones followed by fabric filters. From the silos, malted grain is pneumatically conveyed to four whole malt scales, which weigh the malt and discharge the proper amount to three malt mills. The malt mills grind the malt, which

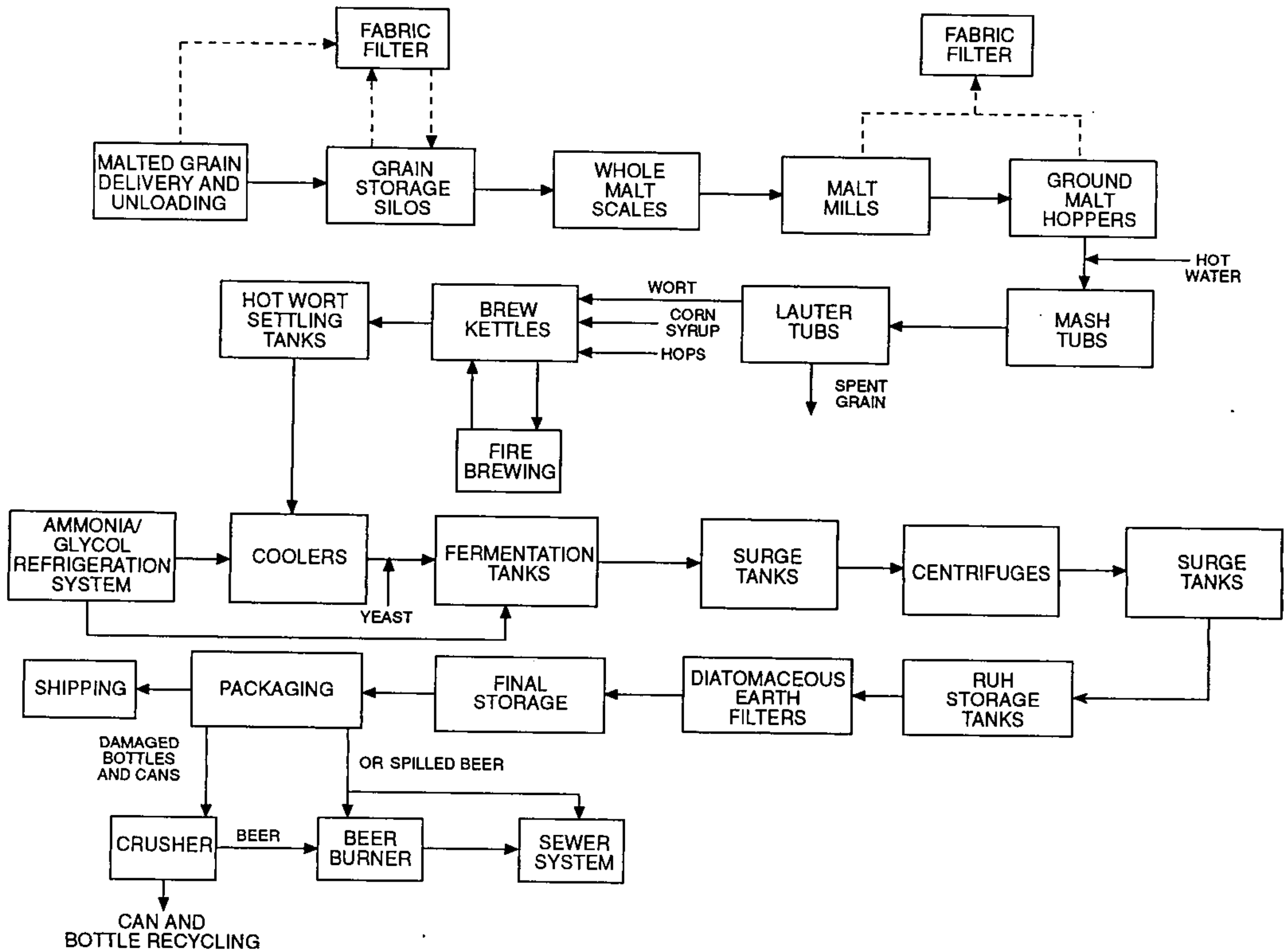

Figure 1. Process flow diagram for Stroh Brewery Company, Winston-Salem, NC.

is then screw-conveyed to two ground (milled) malt hoppers. Particulate matter emissions from the malt mills and milled malt hoppers are controlled by a fabric filter. From the milled malt hoppers, the ground malt is gravity fed to two mash tubs where hot water is added as the malt is being fed. The mixture is heated in the mash tubs. The product, known as mash, is pumped to one of two lauter tubs, in which the wet grain is separated from the mash to produce wort. The mash tubs and lauter tubs are all vented to the atmosphere through natural draft stacks. The liquid wort from the lauter tubs is transferred to one of four brew kettles, and the wet or "spent" grain from the lauter tubs is pneumatically conveyed to the spent grain tank and is sold to a neighboring facility that adds dry ingredients to reduce the moisture content and processes the grain. In the brew kettles, hops and corn syrup are added to the wort and the mixture is boiled for an extended period of time. In addition to boiling in the brew kettles, the several Stroh's brands of beer are cycled through a direct-fired brewing process. The wort is then transferred to one of four hot wort settling tanks where the hot wort is held to allow settling of insoluble material called trub; the trub is introduced into the spent grains for drying and processing. Emissions from the brew kettles are ducted to the atmosphere through four forced-air stacks, and the hot wort settling tanks are vented through a natural draft stack. The hot wort is pumped to coolers, which cool the liquid from about 99°C (210°F) to about 13°C (56°F). The cooling system is a chilled-water heat exchanger; water is chilled by an ammonia-based, refrigeration system. The only potential emissions from the plant refrigeration system are fugitive ammonia emissions from valves or seals. Yeast, which is collected from previous fermentations in several yeast tanks, is mixed with the cooled wort as it is pumped into the fermentation tanks.

The plant has 86 fermentation tanks, each of which typically holds about 1270 barrels of liquid. The liquid is typically fermented for approximately a week. The fermentation tanks are vented to the atmosphere (through a single six inch diameter stack) for the first 12 to 14 hours of the fermentation process. This is a potential VOC source. For about seven days (following the initial 12 to 14 hours), the emissions from the fermentation tanks are collected for the purpose of recovering the carbon dioxide (CO_2) generated during fermentation. Impurities in the CO_2 are removed by a wet scrubbing and carbon adsorption system; impurities collected in the carbon bed are released to the atmosphere as emissions during carbon regeneration. From the fermentation tanks, the liquid is transferred to surge tanks, and then processed through a centrifuge to remove the yeast. After the centrifuge, the liquid is aged for 7 to 14 days in "ruh" storage tanks. The ruh storage tanks are vented to the room on filling and emptying. Following ruh storage, the liquid is sent through a filtration process. Diatomaceous earth is added to the ruh and the mixture passes through a filtration system that includes surge tanks, a prefilter, final filter, and trap filter.

This diatomaceous earth filtration process removes any remaining impurities in the beer. Carbonated water is added to the liquid and the beer is then pumped to final storage in packaging release tanks. The surge tanks used in the filtration process and the packaging release tanks are maintained under counterpressure using CO_2 (i.e., they are not vented to the atmosphere, except prior to and during cleaning).

The diatomaceous earth used in the filtration process is received in 50 lb bags; the earth is dumped into a mix tank and mixed with water to form the slurry which is used during filtration. The mix tank is a potential source of fugitive particulate matter emissions. The mix tanks were covered; the door in the cover was hooded and the exhaust is vented to a baghouse prior to discharge to the atmosphere.

From final storage, the beer is racked, canned, or bottled by several filling lines located in a large building. The two enclosed filling lines, for nonpasteurized products, were not operating during the visit. The canning lines that were operating did not appear to spill much beer, and some of the lines were shrouded at the point where spillage occurred. The shrouds contained the spilled beer which drained quickly into catchpans connected to the collection system, thus limiting potential ethanol emissions. One canning line was not shrouded, and beer spillage was more noticeable; more beer appeared to escape capture by the catch pans and instead ended up on the floor where it subsequently flowed to a floor drain. The waste beer collected at the fillers is pumped to the alcohol stripper.

Damaged and partially filled cans and bottles from the filling lines are deposited in bins that feed two crushers, one can crusher and one bottle crusher. Beer from the crushed cans and bottles is collected in the waste beer collection system. The waste beer is pumped from the collection tank to the alcohol stripper. The cans and bottles are recycled. The alcohol stripper is a submerged combustion system that is a major source of ethanol emissions, but as discussed earlier, it is going to be replaced in the near future.

IV. Conclusions

The site visit was informative and assisted in identifying the potential sources of emissions which include:

PM -- Grain/malt handling
-- Diatomaceous earth mixing

VOC -- Brew kettle
-- Lauter tub
-- Hot wort settle tank
-- Fermentation
-- Ruh storage

-- Bottling
-- Waste beer handling

CO_2 -- Fermentation
Other -- Ammonia from refrigeration system