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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: 9.13.3

Background Chapter: 2

Reference Number: 7

Title: Memorandum. D. March, Midwest Research Institute, to D. Safriet, EPA/EIB. Trip Report, Frito-Lay, Inc., Charlotte, NC

March, D.

September 1993



AP-42 Section _____
Reference _____
Report Sect. 2
Reference 7

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Date: March 14, 1994
(Finalized April 7, 1994)

Subject: Site Visit--Frito-Lay, Incorporated
Emission Factor Documentation for AP-42, Section 6.13.3
EPA Contract No. 68-D2-0159; MRI Project No. 4601-08

From: Dan March

To: Dallas Safriet
TSD/EIB
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

I. Purpose

The purpose of the visit was to obtain information on the production of potato and corn snack chips. This information will be used to revise AP-42 Section 6.13.3, Deep Fat Frying--Snack Chips.

II. Place and Date

Frito-Lay, Incorporated
2911 Nevada Boulevard
Charlotte, North Carolina

September 14, 1993

III. Attendees

Frito-Lay, Incorporated

Bill Moore, Group Manager
Environmental and Mechanical Engineering
Dallas, Texas

Dennis Zito
Charlotte, North Carolina

Brian Klepp, Maintenance Supervisor
Charlotte, North Carolina

U. S. Environmental Protection Agency (EPA)

Dallas Safriet, EIB
Dee Graf, EIB

Midwest Research Institute (MRI)

Roy Neulicht
Dan March

IV. Discussion

A meeting was held with Frito-Lay personnel to discuss the objectives of the visit and the status of work performed to revise the AP-42 emission factors for Section 6.13.3, Deep Fat Frying--Snack Chips. This discussion was followed by a tour of the production facility. The following discussion is a description of deep fat fryers and toasters used to produce corn and potato snack chips at Frito-Lay in its Charlotte, North Carolina, facility. A detailed process description of deep fat fryers is presented in the Final Draft Report of AP-42, Section 6.13.3, and is not repeated here.

A. Production

Frito-Lay produces several types of snack chips in their Charlotte, North Carolina, facility. Each type of chip is produced by one of the cooking processes discussed below. Only continuous processes are used at the Charlotte facility; batch kettle fryers are not used. The different process lines used are described in the following sections.

1. Steam heated potato chip fryer. A diagram of a typical steam-heated, potato chip fryer is presented in Figure 1. As indicated in Figure 1, after proceeding through a cleaning process (washing and peeling), the potatoes are sliced and discharged into a deep fryer. Steam heated fryers are the most common type of fryer used by Frito-Lay in their Charlotte facility. The fryers vary in size according to the moisture content of the raw material. Potatoes, which have a moisture content of about 80 percent, require much larger fryers than corn, which has a moisture content of about 40 percent.

The higher moisture content of potatoes versus corn results in two differences in the deep fat fryers used:

1. The moisture emitted from cooking potatoes removes a substantial amount of heat energy from the cooking oil in the dewatering zone of the fryer, thus requiring additional fryer length to maintain the minimum contact time at the target temperature required for cooking.

2. More make-up oil is required for cooking potatoes than corn for two reasons, both related to the moisture content of the potatoes. The moisture from potato slices emitted as steam from below the surface of the oil causes a boiling action that strips oil droplets from the oil surface. According to Mr. Moore, eighty to ninety percent of these droplets are removed from the

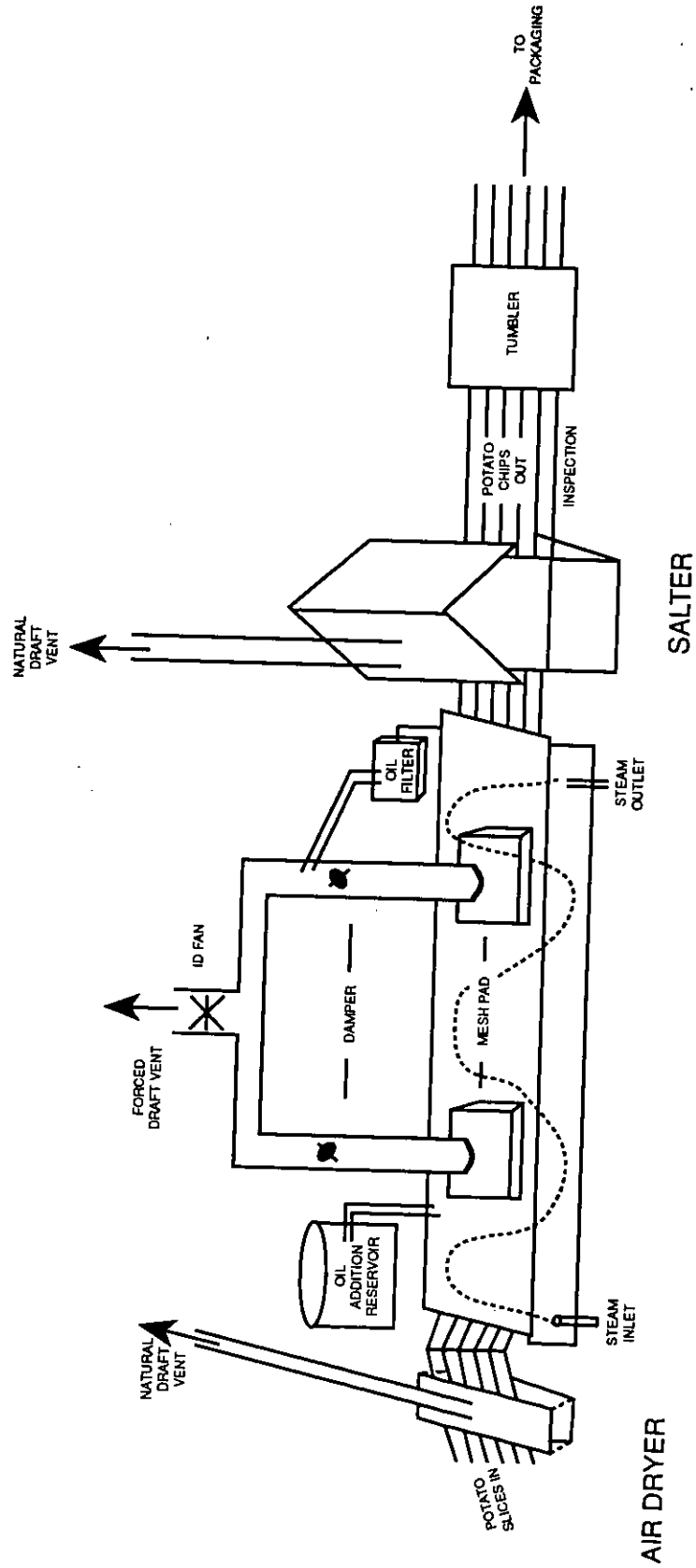


Figure 1. Potato chip fryer line.

vapor streams and collected as liquid oil, the remainder are discharged with the moisture. Also, oil is lost during fry cooking because the water in the food is replaced by the oil. Therefore, potatoes require about twice as much make-up oil as corn to replace moisture contained in the chips.

The deep-fat fryers used for potato chips have two process vent ducts. The first is located near the raw material inlet and the second is located near the chip exit. Each vent duct is equipped with a mesh pad demister; the vents are ducted to a common induced draft fan and stack to atmosphere. A portion of the fryer oil is recirculated through a filter as a normal part of the process. The filter tank also is vented to the process stack.

The demister pads are located at the base of the exhaust duct just above the fryer. The pads are 1 meter (m) by 1 m (3 feet [ft] by 3 ft) wide and 0.2 m (8 inches [in.]) thick. Each pad is composed of four 1 m by 0.2 m by 0.2 m (3 ft by 8 in. by 8 in.) sections of stainless steel mesh arranged horizontally. Demister pads are cleaned weekly by immersion in sodium hydroxide (NaOH) followed by boiling in water, rinsing and drying. The entire cleaning process takes about 12 hours.

2. Steam heated corn chip, multigrain chip, and tortilla chip fryer line. A diagram of a typical corn chip, multigrain chip, and tortilla chip fryer line is presented in Figure 2. As indicated in Figure 2, the prepared snack material to be fried is first extruded and cut; next, the material either enters a toaster prior to discharge to the deep fat fryer (tortilla chips), or is discharged directly into the fryer. The toasting oven assembly is used only for tortilla chips. The configuration contains three elements: a toaster, a drying stand, and a fryer.

The toaster is a natural gas direct-fired oven. Mr. Moore indicated that the toaster oven on the line observed typically is rated at less than 2×10^6 Btu's. The toaster has two exhaust ducts for venting the natural gas combustion products and the moisture given off by the chips. These exhaust ducts are natural draft controlled by a barometric damper; they are not equipped with any air pollution control device. The drying stand allows additional moisture to be given off from the chips as they cool. The drying stand has no exhaust collection or emission control system.

The fryer used in this process line typically is smaller than the fryers used for potato chips, since the moisture content of corn is less than that of potatoes. The natural draft fryer exhaust ducts on this process line are not equipped with an air pollution control device (i.e., mesh pad demister). However, Mr. Moore indicated that mesh pad demisters are sometimes used on this type process line (e.g., in California). The filter tank for the fryer oil purifier is vented to the fryer vent duct. The

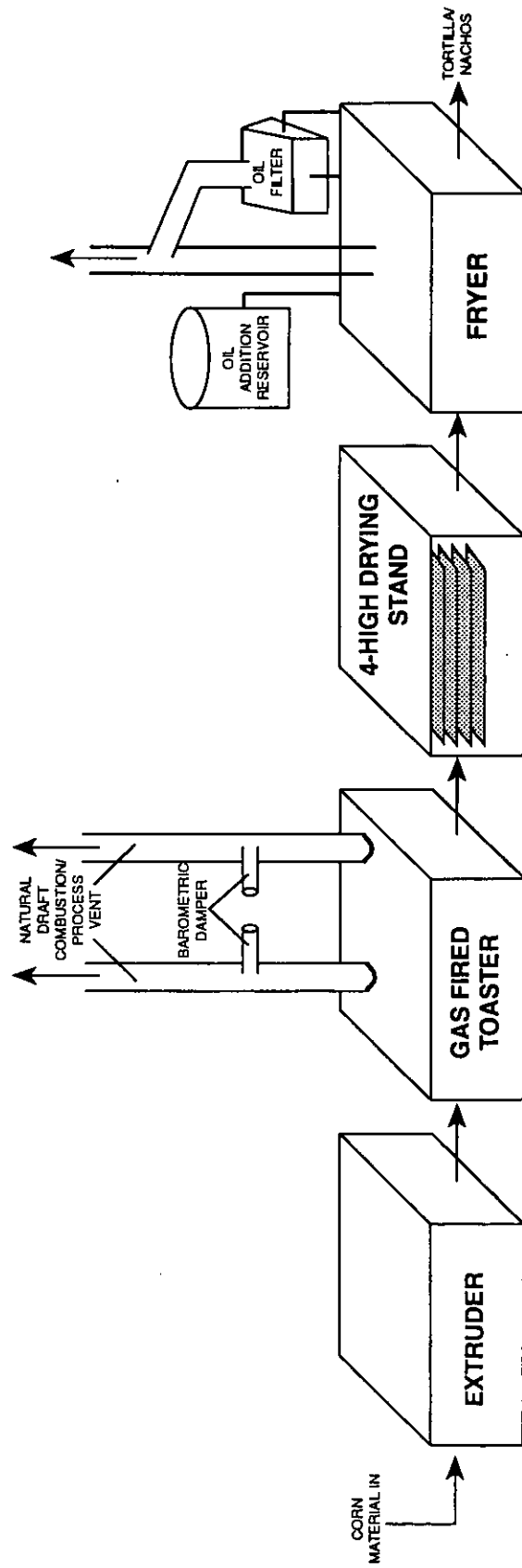


Figure 2. Tortilla corn chip fryer line.

area where salt is applied to the chips also is vented to the atmosphere via a natural draft stack.

3. Gas fired fryers. At least one older direct gas fired fryer is still in operation at this facility. The configuration of gas fired fryers is similar to but smaller than steam heated fryers.

As with the steam heated fryers, an exhaust duct above the surface of the frying oil is located in about the first third of the length of the fryer. A separate combustion exhaust duct vents the combustion products from the natural gas burner that heats the fryer. Both ducts use natural draft to exhaust emissions. Neither duct is equipped with any type of air pollution control device.

B. Materials

Frito-Lay uses cottonseed, soybean, and canola oils to cook potato and corn chips. Other oils such as peanut oil and corn oil can also be used for this purpose.

Commercially available and in-house designed fryers are used by Frito-Lay. The commercial fryers are manufactured by Heat and Control, Salvo, and Southoak. A fourth fryer supply company, no longer in business, is Ferry.

C. Starch Recovery Unit

The sliced potatoes are water washed before they are introduced into the fryer. The starch released from sliced potatoes would create a high total suspended solids (TSS) if the wash water was discharged to the wastewater system. Instead, the water is air evaporated and the resulting dry starch is recovered in a cyclone separator and sold. Facility personnel indicated that about 1 lb of starch is recovered per 100 lb of potatoes processed. The cyclone discharge is a potential particulate matter emission source.

V. Summary

The site visit was instructive with regard to gaining a better understanding of the overall design and operation of deep fat-fryers used for snack foods. This facility produces two types of products: (1) potato chips and (2) other snack chips. Two differences in these products were noted: (1) the emissions from the potato chips fryers are controlled using a mesh pad demister while the emissions from the other fryers are uncontrolled, and (2) a direct-fired natural gas toaster is incorporated into the process line for some of the other snack foods (e.g., tortilla chips).



March 18, 1994

Dallas Safriet
Emission Inventory Branch
US EPA
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

Dear Mr. Safriet

Thank you for sending me, for my review, the Site Visit report from September 14, 1993 tour of Frito-Lay's Charlotte, N.C. facility. With your inclusion of the following comments I will consider the information accurate and not confidential business information.

1. Page One, III Attendees
Brian Klepp is the Maintenance Supervisor who participated

2. Page 2, Sec A., 1st Paragraph
Reads:
"Frito-Lay produces four types of snack chips..."
Delete the reference to Frito-Lay products and brands.
Change to read:
"Frito-Lay produces several types of snack chips in their N.C. facility. Each type of chip is produced by one of the cooking processes discussed below."

3. Page 4, 1st Paragraph
Reads:
"...oil droplets from the oil surface; these droplets are exhausted with the moisture."
Change to read:
"...oil droplets from the oil surface. Eighty to ninety percent of these droplets are removed from the vapor streams and collected as liquid oil, the remainder are discharged with the moisture."

moore #4 charepa.sam

March 18, 1994
Dallas Safriet

4. Page 4, Section 2, 2nd Paragraph

Reads:

"Mr. Moore indicated that the toaster oven typically is rated at less than 2×10^6 BTU's"

Change to read:

"Mr. Moore indicated that the toaster oven on the line observed typically is rated at less than 2×10^6 BTU's."

5. Page 6, Section C

Reads:

"...biological oxygen demand..."

Change to read:

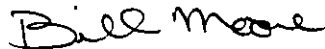
"...total suspended solids (TSS)..."

With these changes incorporated, the document is accurate and need not be classified as confidential. Thank you for your diligence in considering Frito-Lay's confidentiality.

If you need additional information, please call me at (214) 334-4881.

Sincerely,

FRITO-LAY, INC.



Bill Moore

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