

SOURCE INVENTORY
CATEGORIES # 28 & 935
LARGE AND SMALL BAKERIES

1999 EMISSIONS

Introduction

Emissions from these categories are from large commercial bakeries as well as smaller bakeries. Bread is produced either by sponge-dough process, brews (or liquid sponges) process, or straight-dough process. Commercial bakeries more often use the sponge-dough process, where ingredients are initially mixed, bread dough fermented from 3 to 5 hours, and then baked in ovens at about 450 °F. Bakery products such as sweet rolls, crackers, pretzels, cakes, cookies, doughnuts, biscuits, etc. are either leavened by yeast or by baking powder. Yeast metabolizes the sugars and starches in the dough during fermentation process. The end product of this chemical reaction is primarily carbon dioxide and ethanol, the latter evaporates and leaves the dough as a pollutant.

Major pollutants emitted from bread baking are primarily ethanol, which is a by-product of the leavening process. Emissions of combustion products from oven stacks are comparatively negligible.

Methodologies

Throughput information from large bakeries are reported and stored in the District's Data Bank system. Source tests, which are conducted at various times, provide the data for emission factors. (During the rulemaking process in the late 1980's, fifteen ovens from six large bakeries in the Bay Area were source tested by the District. Ethanol emissions ranged from 0.3 to 7.0 pounds per thousand pounds bread produced, depending on the oven size, operating temperature, and type of product.) Emissions from these larger bakeries are called point sources (Cat# 28).

There are still numerous smaller bakeries in the Bay Area, which are not in the Data Bank system. These bakeries use smaller ovens. Source test results showed an emission factor of 2.7 pounds ethanol per thousand pounds of bread produced. Emissions from these smaller bakeries are called area sources (Cat # 935).

Throughput data for small bakeries was based on a survey regarding the large bakeries. Small Bakeries showed an approximately 37% share of the total bread market. The 1999 average daily throughput from smaller bakeries was calculated to be about 578,636

pounds of bread (105,601 tons/year). TOG emissions from small bakeries were 1,562 pounds/day (0.78 ton per day).

Small Bakeries (Area Sources):

$$\text{TOG Emission} = \text{throughput} \times \text{Emission Factor}$$

$$\begin{aligned} \text{TOG Emission} &= 105,601 \text{ tons bread/yr.} \times 5.4 \text{ lbs./ton bread} / 365 \text{ days/year} \\ &= 1,562 \text{ lbs./day, or } 0.78 \text{ ton/day} \\ &\text{(uncontrolled organic emission)} \end{aligned}$$

Monthly Variation

For large bakeries, monthly distribution was based on each company's reported quarterly seasonal percent throughput data. For small bakeries (area sources), monthly distribution was based on a 1990 production of a large bakery which is assumed to be typical.

County Distribution

The county locations of each of the large bakeries were used to distribute countywide emissions. For small bakeries, the number of large bakeries was subtracted from the total number of bakeries in each county found in the 1997 County Business Patterns.

TRENDS

History

Historical emissions were estimated using actual throughputs and ARB's growth profile on food output in the manufacturing sector. District Regulation 8, Rule 42 setting standards for new and modified bakery ovens on large commercial bakeries became effective January of 1989.

Growth

Emissions projections to year 2030 was also based on ARB's growth profile on food output in the manufacturing sector, and is expected to grow annually at an average of approximately 1.3%.

Control

District Regulation 8, Rule 42 was amended requiring control equipment for existing ovens which commenced operation prior to January 1989. This became effective starting January 1992. As of 1999, an estimated 80% overall control (on large bakeries) has resulted due to this rule.