CHATTANOOGA-HAMILTON COUNTY AIR POLLUTION CONTROL BUREAU

Statement of Basis
Part 70 Permit No. 47-065-5700

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Emission Unit No.	Description
003	Aluminum Isopropoxide and Aluminum sec-Butoxide Production
004	Aluminum Isopropoxide Drumming Operation
005	Aluminum Derivatives Production
006	Aluminum Monoacetate Spray Dryer
008	Glycine Production
009	Hamposyl® Production
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011	Specialty Pharmaceuticals Production
012	Raw-Material and Solvent Storage Tanks
013	Johnston and York-Shipley Boilers and Power Flame Thermal-Fluid Heater

Purpose

Chattem Chemicals, Inc., has applied for the renewal of their Part 70 (Title V) permit. This company name is registered as an active entity with the Tennessee Secretary of State. This statement of basis includes discussions of the operation of the permitted equipment, the air pollutant emissions, and the applicable regulations. It has been adapted from the Bureau annual inspection report for Chattem Chemicals dated September 30, 2025.

Process Description

Chattem Chemicals manufactures pharmaceutical and other specialty chemicals. All of these chemicals are made by batch reactions, with the exception of Hamposyl® surfactants, which are produced by a continuous reaction.

Aluminum isopropoxide (AIP, aluminum isopropylate, $Al[OCH(CH_3)_2]_3$) is made by reacting scrap aluminum with excess isopropanol [IPA, isopropyl alcohol, 2-propanol, $(CH_3)_2CHOH$]. Aluminum sec-butoxide (ASB, $Al[OCH(CH_3)CH_2CH_3]_3$) is made in a similar fashion by reacting scrap aluminum with excess sec-butyl alcohol (SBA, sec-butanol, 2-butanol, $CH_3CHOHCH_2CH_3$). Either AIP or ASB can be made in Reactor R-104 or R-107 (**Emission Unit 003**), both of which are located in the Chattem I building. AIP is currently produced in Reactor R-107, which has a capacity of 2,000 gallons, and ASB is currently made in Reactor R-104, which has a 300-gallon capacity. The resulting AIP or ASB product from each reactor is purified in a still and sent to a receiving tank.

Volatile organic compound (VOC) emissions of isopropanol result from either reactor when it is being used to manufacture AIP, and VOC emissions of sec-butyl alcohol occur from either reactor during ASB production. The VOC emissions from each of the two reactors are controlled by a shell-and-tube condenser followed by a spiral condenser. The condensed isopropanol or sec-butyl alcohol is refluxed back to the reactor.

Liquid AIP product from either of the two receiving tanks may be transferred to a weigh tank for that receiving tank and packaged into drums. After this product has hardened in a drum, it is augured out of the drum, pulverized in a granulator, and re-drummed (**Emission Unit 004**). Particulate matter (PM) emissions from both the granulator and final drumming station are controlled by a baghouse. The two initial drumming stations for the liquid product are also vented to this baghouse, although no PM emissions result from them. In addition, uncontrolled VOC emissions of isopropanol result from the decomposition of AIP dust that is collected by the baghouse.

Any of nineteen different aluminum derivatives can be made in any of Reactors R-101, R-102, R-103, and R-106 (**Emission Unit 005**). Each of Reactors R-101, R-102, and R-106 has a capacity of 1,500 gallons, and the capacity of Reactor R-103 is 1,600 gallons. All four of these reactors are located in the Chattem I building. The various aluminum derivative products include food additives, ink ingredients, and chelating agents. Fourteen of these products are made by using AIP as a reactant, one of them uses ASB as a reactant, and the remaining four products are mixtures that contain either AIP or AIP-derived products. VOC solvents and other VOC reactants that can be used in the manufacture of these products include isopropanol, sec-butyl alcohol, acetic acid, ethyl acetoacetate [$CH_3(C{=}O)CH_2COOCH_2CH_3$], 2-ethyl hexanoic acid [$CH_3(CH_2)_3CH(CH_2CH_3)COOH$], xylene [dimethylbenzene, $C_6H_4(CH_3)_2$ (any of three isomers)], mineral spirits, N40 HT oil, and Vista 47 oil.

Any of the four reactors is charged from a weigh tank, and minimal uncontrolled VOC emissions may occur during charging. Isopropanol is formed as a byproduct of any of the fourteen reactions that involve AIP, and sec-butyl alcohol is a byproduct of the reaction that makes use of ASB. The resulting isopropanol or sec-butyl alcohol is distilled from the solution in a reactor after the reaction is complete. VOC emissions, including emissions of isopropanol or sec-butyl alcohol, from each reactor, while being used to make any product involving a reaction, are controlled by two condensers in series. Each of Reactors R-101, R-102, and R-103 use a shell-and-tube condenser followed by a spiral condenser, and Reactor R-106 is served by two spiral condensers in series. Condensed isopropanol or sec-butyl alcohol is initially refluxed back to the reactor during the reaction phase, and isopropanol that is condensed during the distillation phase in a reactor is collected as an aqueous azeotropic solution in a sealed horizontal tank for that reactor. VOC emissions that occur from any reactor while being used to make a product mixture that does not involve a reaction are uncontrolled.

The liquid products are packaged in drums. Reactors R-101 and R-102 are served by a common drumming station, while a separate drumming station serves Reactor R-103. Any VOC emissions that are vented from either drumming station are controlled by a single packed-tower scrubber that uses water as the scrubbing medium.

Aluminum monoacetate [$CH_3COOAl(OH)_2$] is the most commonly produced aluminum derivative. It is made by reacting AIP with acetic acid (CH_3COOH) and water. Isopropanol is used as the solvent for the reaction, and additional isopropanol is formed as a reaction byproduct. It is normally made in Reactors R-103 and R-106.

Aluminum monoacetate slurry from the reactors is dried in a spray dryer (**Emission Unit 006**) that is directly heated and fueled exclusively by natural gas. Process PM emissions from the spray dryer and filterable PM emissions that result from fuel combustion in it are controlled by a baghouse. Process VOC emissions of acetic acid and isopropanol from the spray dryer and other emissions that result from fuel combustion in it are uncontrolled.

Glycine (aminoacetic acid, NH_2CH_2COOH) is made by reacting chloroacetic acid (MCA, monochloroacetic acid, $CH_2ClCOOH$) with excess ammonia (NH_3) in Reactor R-301A (**Emission Unit 008**) in the presence of hexamethylenetetramine [HMTA, $(CH_2)_6N_4$] catalyst. This process is predominately located in the Chattem III building. An aqueous solution of 80% MCA is supplied to this process from Storage Tanks T-313 and T-314, which each have a capacity of 4,500 gallons. Uncontrolled VOC emissions of MCA from these tanks due to standing storage losses are negligible because the tanks are indoors and share a common conservation vent. No emissions result from these two tanks as working losses because they are loaded by way of a vapor balance system. Ammonia for this process is stored in a pressurized tank that is not vented to the atmosphere and therefore results in no emissions.

Following Reactor R-301A and a precooling vessel, the resulting glycine is precipitated out of solution by mixing it with cold methanol (methyl alcohol, CH_3OH) in Initial Crystallization Tank T-304. The glycine is separated from the methanol in a centrifuge. The glycine from the centrifuge is then purified by first melting it in Recrystallization Melt Tank T-307 that is heated by non-contact steam and mixing it in this tank with saturated glycine from "mother liquor" Supply Tank T-302. It is next recrystallized in either Final Crystallization Tank T-308 or T-320. As the final purification step, the glycine is sent to either of three double-cone rotating vacuum dryers where it is filtered to remove the mother liquor, washed with fresh methanol, and dried. The mother liquor from the filtering stage in the dryers and a recycle stream of mother liquor from each of Tanks T-308 and T-320 is sent to Tank T-302. The used methanol from the washing stage in the dryers is sent to Tank T-304. Methanol that results from the drying stage in each of the three dryers is vented to separate sealed condensers that are not exhausted to the atmosphere.

The purified glycine from the dryers is ground in a mill that is located in the Chattem IV building. The ground glycine is then packaged in bulk bags. PM emissions from the mill are controlled by a baghouse. These emissions are considered to be less than 0.5 lb/hr before being controlled. The mill is therefore classified as an insignificant activity in accordance with §4-56(c)(12)(ii).

Virgin methanol, for supplying the two dryers, is received at the plant by tank truck and loaded into Storage Tank T-312. Used methanol both from the centrifuge and from the two condensers of the dryers contains ammonia that is neutralized in Feed Tank T-310 by the addition of hydrochloric acid (HCl) and then sent to a distillation column. The distilled methanol is then collected in Receiving Tank T-315, chilled in a non-contact heat exchanger, and sent to Feed Tank T-311 that supplies the initial crystallization tank. Tank capacities are approximately 10,000 gallons for each of Tanks T-312 and T-311, 8,500 gallons for Tank T-310, and 2,300 gallons for Tank T-315.

VOC emissions of methanol result from Initial Crystallization Tank T-304, the centrifuge, Recrystallization Melt Tank T-307, Final Crystallization Tanks T-308 and T-320, Supply Tank T-302, Virgin Methanol Storage Tank T-312, Methanol Column Feed Tank T-310, Distilled Methanol Receiving Tank T-315, and Chilled Methanol Feed Tank T-311. All of these VOC emissions of methanol are controlled by a single spiral condenser. Reactor R-301A and the precooling vessel are also vented to this condenser, although no VOC emissions are considered to result from them. The emissions from Tanks T-312, T-310, T-315, and T-311 occur as both working losses and standing storage losses. The standing-storage loss emissions are minimized because each of these five tanks is equipped with a conservation vent. Ammonia emissions from Reactor R-301A and minimal emissions of hydrogen chloride (HCl) from Methanol Column Feed Tank T-310 are uncontrolled.

Fugitive VOC emissions of methanol occur from the valves, pumps, agitators, and connectors of the glycine production process. All of these components are monitored periodically to detect leaks of methanol and are repaired, if necessary, in accordance with a leak detection and repair (LDAR) program.

Hamposyl® is a class of surfactant that is used in such things as hair care products. It is made by reacting fatty acid chlorides with sodium sarcosinate (CH_3NHCH_2COONa) in a tube reactor (**Emission Unit 009**) that is located in the Chattem IV building. An aqueous solution of 30% isopropanol is used for viscosity control in the production of two of the varieties of Hamposyl® ("M" and "O") that are made. VOC emissions of isopropanol from a phase separation vessel, purification vessel, and intermediate product tank of this process are controlled by a single spiral condenser. Wastewater from the process contains used isopropanol and is sent to either of two indoor agitated tanks that each have a capacity of 15,000 gallons. VOC emissions of isopropanol resulting from these tanks are uncontrolled.

Pamabrom, which is a diuretic medication, is a mixture of 8-bromotheophylline [8-BT, $N(CH_3)(C{=}O)N(CH_3)(C{=}O)C{=}CN{=}CBrNH$] and isobutanolamine [2-AMP, 2-amino-2-methyl-1-propanol, $CH_3C(CH_3)NH_2CH_2OH$]. The 8-BT ingredient is made by reacting powdered theophylline [$N(CH_3)(C{=}O)N(CH_3)(C{=}O)C{=}CN{=}CHNH$] with liquid bromine in an aqueous solution of acetic acid buffered with sodium acetate (CH_3COONa) in Reactor R-502 (**Emission Unit 010**), which is located in Building 33. 8-BT from the reactor is washed several times in three crock filters in parallel. All of these washings use water except for the final washing, which uses methanol. PM emissions and VOC emissions of acetic acid from the reactor and VOC emissions of methanol from the three crock filters are controlled by a single packed-tower scrubber that uses an aqueous solution of 10% sodium hydroxide (caustic, NaOH) as the scrubbing medium. The filtered 8-BT is dried in a vacuum shelf dryer in which conductive heating occurs as a heated fluid is circulated through tubes in the dryer shelves. VOC emissions of methanol from the dryer are controlled by a spiral condenser. The condensed methanol is sent to Receiving Tank T-315 of the glycine production process (Emission Unit 008). The dried 8-BT is then mixed with isobutanolamine to form the pamabrom product. This mixing operation results in no emissions because it is performed within an enclosed room that is not vented to the atmosphere.

Any of twenty-nine specialty pharmaceuticals can currently be made in several diverse reaction trains (**Emission Unit 011**) that are dispersed throughout eleven areas (Suites A, B1, B2, C1, C2, D1, D2, E, F, G, and H) within the Chattem II building and one area (Suite 5D) in the Chattem V building. All of these pharmaceutical products are made in small batches, and most of them are subject to production limits that are mandated by the U.S. Drug Enforcement Administration. Batch reactors and other process vessels in the reaction trains are interchangeable. Following the reaction, steps in the production of a specialty pharmaceutical can include crystallization, distillation, washing, filtration, drying, and packaging.

VOC that can be emitted from the batch reactors and dryers of the reaction trains include methanol, ethanol (ethyl alcohol, CH_3CH_2OH), isopropanol, n-butanol (n-butyl alcohol, 1-butanol, $CH_3CH_2CH_2CH_2OH$), hexane [$CH_3(CH_2)_4CH_3$], methyl bromide (bromomethane, CH_3Br), isobutyl bromide [1-bromo-2-methylpropane, $(CH_3)_2CHCH_2Br$], and acetic acid. VOC emissions and any emissions of acetone [dimethylketone, $CH_3(C{=}O)CH_3$] from the reactors and dryers are controlled either by a single condenser or by two condensers in series. Any emissions of hydrogen chloride or hydrogen bromide (HBr) from the reactors are controlled either by a single pot scrubber or by two pot scrubbers in series that use either an aqueous solution of 10% caustic or an aqueous sodium sulfite (Na_2SO_3) solution as the scrubbing medium.

Various bulk VOC raw materials and solvents for the plant are stored in tanks **(Emission Unit 012)**, and emissions from these tanks are of the VOC that is being stored. Virgin isopropanol, sec-butyl alcohol, and ethyl acetoacetate are used in the production of aluminum derivatives (Emission Unit 005) and are stored in Tanks VA-7000, T-129, and T-131, respectively. Virgin isopropanol is also used to make AIP (Emission Unit 003) and aluminum monoacetate (Emission Unit 005), and sec-butyl alcohol is also used for ASB production (Emission Unit 003). Aqueous 30% isopropanol solution, which is used for Hamposyl® production (Emission Unit 009), is stored in Tank T-508. All four of these raw materials are loaded into their respective storage tanks by way of tank trucks. Furthermore, isopropanol distillate is recovered from the production of AIP, aluminum monoacetate, and aluminum derivatives. Isopropanol distillate that is reusable in the plant is stored in Tank-135, and sellable isopropanol distillate is stored in Tank T-142.

Tank capacities are approximately 17,000 gallons each for Virgin Isopropanol Storage Tank VA-7000, Dilute Isopropanol Storage Tank T-508, and Sellable Isopropanol Distillate Storage Tank T-142 and 10,000 gallons each for sec-Butyl Alcohol Storage Tank T-129, Ethyl Acetoacetate Storage Tank T-131, and Reusable Isopropanol Distillate Storage Tank T-135. VOC emissions from the six storage tanks are uncontrolled and occur as both working losses and standing storage losses. The standing-storage loss emissions are minimized because each tank is equipped with a conservation vent. In addition, Tank-132, which has a capacity of 10,000 gallons and is currently empty, may be used in the future for additional storage of virgin isopropanol.

An aqueous solution of 35% hydrochloric acid is used in glycine production (Emission Unit 008). It is stored in a tank that has a capacity of 10,000 gallons. Emissions of hydrogen chloride from the tank are controlled by a packed-tower scrubber that uses water as the scrubbing medium. The hydrogen chloride emissions from this tank occur as both working losses and standing storage losses.

N40 HT oil and Vista 47 oil are also used in the production of aluminum derivatives, and an aqueous solution of 43% hexamethylenetetramine is used in the manufacture of glycine (Emission Unit 008). These three raw materials are stored in Tanks T-133, T-134, and Tank-316, respectively. Each of them has a very low vapor pressure, and VOC emissions that result from their storage are negligible.

Process steam and space heating for the plant are provided by a Johnston boiler, additional process steam for the glycine production process (Emission Unit 008) is provided by a York-Shipley boiler, and a Power Flame thermal-fluid heater **(Emission Unit 013)** supplies additional process heat. Both of the boilers and the heater are fueled exclusively by natural gas. Emissions that result from fuel combustion in them are uncontrolled.

Evaluation

Emission Unit 003 Aluminum Isopropoxide and Aluminum sec-Butoxide Production

441 tons of AIP and 13 tons of ASB were manufactured in the AIP and ASB production process during the twelve-month period from June 1, 2024, through May 31, 2025. The estimated VOC emissions from this process are given below in Table I. The VOC emissions of isopropanol were calculated by using an emission factor of 18.22755 lb/ton AIP, and the VOC emissions of sec-butyl alcohol were calculated by using an emission factor of 65.70280 lb/ton ASB. The potential emissions are based on producing 1,130.0 tons/yr of AIP and 80.0 tons/yr of ASB.

Table I. VOC Emissions from the AIP and ASB Production Process

Pollutant	Actual Emissions *tons/yr*	Potential Emissions *tons/yr*	Allowable Emissions *tons/yr*
Isopropanol (VOC)	4.019	10.299	13.0
Sec-butyl Alcohol (VOC)	0.427	2.628	
Total VOC	**4.446**	**12.927**	**13.0**

The AIP and ASB production process was most recently modified in 2022 by the replacement of a former reactor with Reactor R-107. The VOC emissions from this process are subject to best available control technology (BACT, Rule 25.3). Control of the VOC emissions from each reactor of this process by two condensers in series has been determined to be BACT. An appropriate BACT limitation for the VOC emissions from this process is 13.0 tons/yr. In addition, appropriate BACT limitations on production are 1,130.0 tons/yr of AIP and 80.0 tons/yr of ASB. The potential VOC emissions that are given in Table I are based upon these production limitations.

Emission Unit 004 Aluminum Isopropoxide Drumming Operation

AIP is pulverized and drummed at a rate of 1,240 lb/hr (0.62 ton/hr). The baghouse has an estimated PM control efficiency of 99.9%. 441 tons of AIP were manufactured in the AIP and ASB production process (Emission Unit 003) during the twelve-month period from June 1, 2024, through May 31, 2025, all of which is assumed to have been pulverized and drummed.

The estimated PM emissions and VOC emissions of isopropanol from the drumming operation are given in Table II, which follows. The PM emissions were calculated by using an emission factor of 0.0093238 lb/ton AIP (1,386 lb/240 hr ÷ 0.62 ton AIP/hr × 0.001/0.999), which was determined by weighing material collected by the baghouse. The VOC emissions were calculated by using an emission factor of 3.28877 lb/ton AIP (1,386 lb/240 hr ÷ 0.62 ton AIP/hr ×

0.882700 lb isopropanol/lb AIP × 0.4), which was stoichiometrically determined based upon 40% of the AIP dust that is collected by the baghouse decomposing to release isopropanol. The hourly potential VOC emissions are based on the decomposition occurring instantly. The potential emissions are based on drumming 1,130.0 tons/yr of AIP, which is the AIP production limitation that is given in Emission Unit 003.

Table II. Emissions from the AIP Drumming Operation

Pollutant	Actual Emissions *tons/yr*	Potential Emissions *lb/hr*	*tons/yr*	Allowable Emissions
Particulate Matter (PM)	0.0021	0.0058	0.0053	0.05 lb/hr
Isopropanol (VOC)	0.725	2.039	1.858	1.90 tons/yr

The AIP drumming operation was installed in 1996. Potential PM emissions from this operation, prior to being controlled, are estimated to be 5.27 tons/yr. Therefore, the PM emissions from the drumming operation are subject to Rule 27.3. Control of these emissions by a baghouse has been determined to be reasonable and proper, in accordance with Rule 27.3. An appropriate reasonable and proper limitation for the PM emissions from this operation has been previously determined to be 0.05 lb/hr. This limitation is more stringent than both the Rule 10.3 (Schedule 2) PM emission limit of 2.67 lb/hr and the Rule 10.7 PM emission limit of 0.25 gr/scf (5.93 lb/hr). This limitation is also more stringent than the Rule 26.13 [reasonably available control technology (RACT)] PM emission limit of 0.020 gr/dscf (0.47 lb/hr), although it is not applicable to the drumming operation.

The VOC emissions from the drumming operation are subject to BACT (Rule 25.3). An appropriate BACT limitation for these emissions is 1.90 tons/yr. No controls are necessary in order to achieve this VOC emission limitation.

Emission Unit 005 Aluminum Derivatives Production

402.5 tons of aluminum derivatives (145 batches), other than aluminum monoacetate, were manufactured in the aluminum derivatives production process during the twelve-month period from June 1, 2024, through May 31, 2025. The actual VOC emissions from this process are estimated to be **1.828 tons/yr**, based on using an emission rate of 25.2144 lb/batch for ketalin, which is the aluminum derivative (other than aluminum monoacetate) that has been determined to have the highest batch emission rate.

The aluminum derivatives production process was most recently modified in 2024 by the replacement of Reactor R-106. The VOC emissions from this process are subject to BACT (Rule 25.3). Control of the VOC emissions from each reactor of this process, while being used to manufacture any product involving a reaction, by two condensers in series has been determined to be BACT. Control of any VOC emissions from each product drumming station of this process by a scrubber has also been determined to be BACT. An appropriate BACT limitation for the VOC emissions from this process is 8.40 tons/yr [excluding any VOC emissions that result from the manufacture of aluminum monoacetate, which are accounted for in the VOC emission limitation for the aluminum monoacetate spray dryer (Emission Unit 006)]. An additional appropriate BACT limitation for the VOC emissions of xylene from this process is 0.06 ton/yr. Xylene is a HAP.

Emission Unit 006 Aluminum Monoacetate Spray Dryer

The spray dryer operates at about 2/3 of its rated capacity of 1.7 MMBtu/hr for 5 hr/batch. The baghouse has an estimated PM control efficiency of 99.9%. 459 tons of aluminum monoacetate *slurry* were manufactured in the aluminum derivates production process (Emission Unit 005) during the twelve-month period from June 1, 2024, through May 31, 2025. This is equivalent to 207 batches, based on 4,437 pounds of aluminum monoacetate slurry (917 pounds of dried aluminum monoacetate) per batch. Natural gas has average and maximum sulfur contents of 0.002 gr/ft^3 and 0.005 gr/ft^3, respectively.

The estimated process emissions of PM and VOC from the spray dryer, including VOC emissions that result from the manufacture of aluminum monoacetate in the aluminum derivates production process, are given below in Table III. The PM emissions were calculated by using an emission factor of 0.0054 gr/dscf, and the VOC emissions were calculated by using an emission rate of 139 lb/batch, both of which were determined by Chattem Chemicals. The potential PM emissions are based on continuous operation, and the potential VOC emissions are based on producing 191.0 tons/yr of dried aluminum monoacetate. The hourly potential VOC emissions are the average for a batch. The process VOC emissions have been calculated to consist of approximately 50.2% acetic acid and 49.8% isopropanol.

Table III. Process Emissions from the Spray Dryer

Pollutant	Actual Emissions *tons/yr*	Potential Emissions *lb/hr*	Potential Emissions *tons/yr*	Allowable Emissions
Particulate Matter (PM)	0.047	0.091	0.399	0.34 lb/hr*
Volatile Organic Compounds (VOC)	14.379	27.800	28.952	29.0 tons/yr

*0.020 gr/dscf

The spray dryer was installed in 1956. The PM emissions from the spray dryer are limited by Rule 26.13 (RACT) to 0.020 gr/dscf (0.34 lb/hr). This limitation is more stringent than both the Rule 10.2 (Schedule 1) PM emission limit of 2.38 lb/hr, based on a process weight of 887.4 lb/hr (4,437 lb slurry/batch ÷ 5 hr/batch), and the Rule 10.7 PM emission limit of 0.25 gr/scf (4.22 lb/hr).

No VOC emission limitation is applicable specifically for the spray dryer. However, the VOC emissions from the aluminum derivatives production process, in which aluminum monoacetate is made, are subject to BACT (Rule 25.3). An appropriate BACT VOC emission limitation for the spray dryer, including VOC emissions that result from the manufacture of aluminum monoacetate in the aluminum derivates production process, has been previously determined to be 29.0 tons/yr. No controls are necessary on the spray dryer in order to achieve this VOC emission limitation. In addition, an appropriate BACT limitation on the production of dried aluminum monoacetate in the spray dryer is 191.0 tons/yr. The potential VOC emissions that are given in Table III are based upon this production limitation.

The estimated emissions of PM, nitrogen oxides (NO_X), carbon monoxide (CO), VOC, sulfur dioxide (SO_2), and greenhouse gases [GHG, actual and carbon dioxide equivalents (CO_2e)] that result from burning natural gas in the spray dryer are given in Table VII at the end of this section. These emissions, with the exception of emissions of GHG, were calculated by using AP-42 (1998) emission factors. The GHG emissions were calculated by using the Tier 1 calculation methodology that is found in §98.33 of 40 CFR Part 98, Subpart C. The potential emissions are based on continuous operation of the spray dryer at its rated capacity while burning natural gas that has the maximum sulfur content. According to AP-42 (1998) emission factors, VOC emissions that result from natural gas combustion consist of 32.7% hexane and 1.5% formaldehyde (methanal, H_2CO), which are both hazardous air pollutants (HAP). GHG emissions that result from natural gas combustion consist mostly of carbon dioxide (CO_2) and include lesser amounts of methane (CH_4) and nitrous oxide (N_2O).

Combustion of natural gas with the maximum sulfur content in the spray dryer results in potential emissions of 0.17 lb/hr for NO_X and 0.0024 lb/hr for SO_2. These emission rates are the effective NO_X and SO_2 emission limitations for the spray dryer, respectively. These limitations are more stringent than the Rule 2.4 NO_X emission limit of 300 ppm (4.29 lb/hr) and the Rule 13.1 SO_2 emission limit of 500 ppm (9.83 lb/hr), respectively. No limitations are applicable for the emissions of CO and GHG from the spray dryer.

Emission Unit 008 Glycine Production

1,233 batches of glycine were manufactured in the glycine production process during the twelve-month period from June 1, 2024, through May 31, 2025. Each batch requires about 6.75 hours.

The estimated VOC emissions of methanol and emissions of hydrogen chloride from this process are given in Table IV, which follows. Methanol and hydrogen chloride are both HAP. The *actual* VOC emissions were calculated by using an emission rate of 31.1 lb/batch, based on the highest actual outlet gas temperature for the condenser of 21 °F, and the *potential* VOC emissions were calculated by using an emission rate of 43.6 lb/batch, based on the maximum allowable outlet gas temperature for the condenser of 32 °F. Both of these emission rates were determined by Chattem Chemicals. The hydrogen chloride emissions were calculated by using an AP-42 (1997) working-loss equation to be 0.01605 lb/batch, all of which is emitted within one hour of a batch. The potential emissions are based on continuous operation. The hourly potential VOC emissions are the average for a batch.

Table IV. Emissions from the Glycine Production Process

Pollutant	Actual Emissions *tons/yr*	Potential Emissions *lb/hr*	Potential Emissions *tons/yr*	Allowable Emissions *tons/yr*
Methanol (VOC)	19.173	6.459	28.292	30.0
Hydrogen Chloride	0.010	0.016	0.010	n/a

Methanol and hydrogen chloride are HAP. The glycine production process is subject to "National Emission Standards for Hazardous Air Pollutants From the Synthetic Organic Chemical Manufacturing Industry" [40 CFR Part 63, Subpart F (§63.100–63.109)], "National Emission Standards for Hazardous Air Pollutants From the Synthetic Organic Chemical Manufacturing Industry for Process Vents, Storage Vessels, Transfer Operations, and Wastewater," [40 CFR Part 63, Subpart G (§63.110–63.153)], and "National Emission Standards for Hazardous Air Pollutants for Equipment Leaks and Fenceline Monitoring for All Emission Sources" [40 CFR Part 63, Subpart H (§63.160–63.184)], as adopted at Rule 16.5(c). LDAR requirements for applicable valves, pumps, agitators, and connectors of this process are given in Subpart H.

The glycine production process was last modified in 1995. The VOC emissions from this process are subject to BACT (Rule 25.3). Control of the VOC emissions from the three crystallization tanks, centrifuge, recrystallization melt tank, mother liquor supply tank, methanol storage tank, two methanol feed tanks, methanol receiving tank, and methanol byproduct storage tank of this process by a condenser has been determined to be BACT. An appropriate BACT limitation for the VOC emissions from this process has been previously determined to be 30.0 tons/yr.

The hydrogen chloride emissions from the glycine production process are subject to Rule 23. It has been determined that no controls are necessary in order to satisfy reasonable and proper control technology, in accordance with Rule 23, for these emissions, and no quantitative reasonable and proper limitation for the hydrogen chloride emissions is necessary.

Emission Unit 009 Hamposyl® Production

5 batches of Hamposyl® product that used isopropanol were manufactured in the Hamposyl® production process during the twelve-month period from June 1, 2024, through May 31, 2025. Each batch requires about 35 hours. The condenser has an estimated VOC control efficiency of 90%.

The estimated VOC emissions of isopropanol from this process are given below in Table V. These emissions are based on an uncontrolled VOC emission rate for each of the two wastewater tanks of 0.18075 lb/hr, which was determined by Chattem Chemicals. This emission rate (prior to being controlled) is also applied to each of the three sources that are controlled by the condenser. The potential emissions are based on operation for 50 batches/yr of product manufactured using isopropanol.

Table V. VOC Emissions of Isopropanol from the Hamposyl® Production Process

Actual Emissions *tons/yr*	Potential Emissions *lb/hr*	*tons/yr*	Allowable Emissions *tons/yr*
0.036	0.416	0.364	0.375

The Hamposyl® production process was installed in 2004. The potential VOC emissions from this process are 14.550 lb/batch. The VOC emissions from this process are subject to BACT (Rule 25.3). Control of the VOC emissions from the phase separation vessel, purification vessel, and intermediate product tank of this process by a condenser has been determined to be BACT. An appropriate BACT limitation for the VOC emissions from this process has been previously determined to be 15.0 lb/batch of any variety of Hamposyl® that is produced using isopropanol, and an appropriate BACT limitation on the production of such batches is 50 batches/yr. The potential VOC emissions that are given in Table V are based upon this production limitation.

Emission Unit 010 8-Bromotheophylline Production

16 batches of 8-BT were dried in the 8-BT production process during the twelve-month period from June 1, 2024, through May 31, 2025. Each batch requires about 47 hours.

The estimated emissions of PM and VOC from the 8-BT production process are given in Table VI, which follows. The PM emissions are considered to be less than 0.020 gr/dscf because the scrubber has an estimated PM control efficiency of 99.6%. The VOC emissions were calculated by using emission rates of 6.8240 lb/batch for methanol and 0.148 lb/batch for acetic acid, both of which were determined by Chattem Chemicals. The potential PM emissions are based on continuous operation, and the potential VOC emissions are based on operation that results in 0.50 ton/yr of VOC emissions. The hourly potential VOC emissions are the average for a batch.

Table VI. Emissions from the 8-BT Production Process

Pollutant	Actual Emissions *tons/yr*	Potential Emissions *lb/hr*	*tons/yr*	Allowable Emissions
Particulate Matter (PM)	0.0064	0.017	0.075	0.017 lb/hr*
Methanol (VOC)	*0.055*	*0.145*	*0.489*	*0.50 ton/yr*
Acetic Acid (VOC)	*0.0012*	*0.0031*	*0.011*	
Total VOC	0.056	0.148	0.500	0.50 ton/yr

*0.020 gr/dscf

Methanol is a HAP. The 8-BT production process is subject to "National Emission Standards for Pharmaceuticals Production" [40 CFR Part 63, Subpart GGG (§63.1250–63.1261)], as adopted at Rule 16.5(c).

The 8-BT production process was last modified in 2001. Potential PM emissions from this process, prior to being controlled, are estimated to be 18.77 tons/yr. Therefore, the PM emissions from this process are subject to Rule 27.3. Control of the PM emissions from the reactor of this process by a scrubber has been determined to be reasonable and proper, in accordance with Rule 27.3. An appropriate reasonable and proper limitation for the PM emissions from this process has been previously determined to be 0.020 gr/dscf (0.017 lb/hr), which is equivalent to the Rule 26.13 (RACT) PM emission limit, although it is not applicable to this process. This limitation is more stringent than both the Rule 10.3 (Schedule 2) PM emission limit of 0.22 lb/hr, based on a process weight of 21.8 lb/hr, and the Rule 10.7 PM emission limit of 0.25 gr/scf (0.21 lb/hr).

The VOC emissions from the 8-BT production process are subject to BACT (Rule 25.3). Control of the VOC emissions from the reactor and three crock filters of this process by a scrubber and control of the VOC emissions from the dryer of this process by a condenser have been determined to be BACT. An appropriate BACT limitation for the VOC emissions from this process has been previously determined to be 0.50 ton/yr. The potential VOC emissions that are given in Table VI are based upon this emission limitation.

Emission Unit 011 Specialty Pharmaceuticals Production

111 batches of products that emit VOC or HAP were manufactured in the specialty pharmaceuticals production process during the twelve-month period from June 1, 2024, through May 31, 2025. The actual VOC emissions from this process are estimated to be **0.687 ton/yr**, based on using an emission rate of 12.3826 lb/batch for diethyl allylisobutylmalonate, which is the specialty pharmaceutical product that has been determined to have the highest batch emission rate.

Methanol, hexane, and hydrogen chloride are HAP. The specialty pharmaceuticals production process is subject to "National Emission Standards for Pharmaceuticals Production" [40 CFR Part 63, Subpart GGG (§63.1250–63.1261)], as adopted at Rule 16.5(c). §63.1255(b) of this subpart stipulates compliance with applicable provisions of "National Emission Standards for Hazardous Air Pollutants for Equipment Leaks and Fenceline Monitoring for All Emission Sources" [40 CFR Part 63, Subpart H (§63.160–63.184)], as adopted at Rule 16.5(c). Requirements for pressure testing of applicable process equipment trains of this process are given in §63.178(b) of Subpart H.

The specialty pharmaceuticals production process was installed in 1999. The VOC emissions from this process are subject to BACT (Rule 25.3). Control of the VOC emissions from each batch reactor and from each dryer of this process by a condenser has been determined to be BACT. An appropriate BACT limitation for the VOC emissions from this process is 12.50 tons/yr. An additional appropriate BACT limitation for the VOC emissions of combined HAP (e.g., methanol and hexane) from this process is 4.50 tons/yr.

The emissions of hydrogen chloride, hydrogen bromide, and acetone from the specialty pharmaceuticals process are subject to Rule 23. Control of the emissions of hydrogen chloride and hydrogen bromide from each batch reactor of this process by a scrubber has been determined to be reasonable and proper, in accordance with Rule 23. Control of the emissions of acetone from each batch reactor and from each dryer of this process by a condenser has also been determined to be reasonable and proper. An appropriate reasonable and proper limitation for the emissions of hydrogen chloride and hydrogen bromide combined from this process is 1.50 tons/yr. No quantitative reasonable and proper limitation is necessary for the acetone emissions.

Emission Unit 012 Raw-Material and Solvent Storage Tanks

1,689,820 pounds of isopropanol were received into the virgin isopropanol storage tank during the twelve-month period from June 1, 2024, through May 31, 2025. The actual VOC emissions of isopropanol from the combined isopropanol tanks were calculated by using an AP-42 (1997) working-loss equation to be **0.350 ton/yr**, based on all of the isopropanol that was received being loaded into Virgin Isopropanol Storage Tank VA-7000, Dilute Isopropanol Storage Tank T-508, and Isopropanol Distillate Storage Tank T-142 in succession.

The raw-material and solvent storage tanks were installed between 1980 and 1997. The VOC emissions from these tanks are subject to BACT (Rule 25.3). Appropriate BACT limitations are 1.0 ton/yr for VOC emissions of isopropanol from Virgin Isopropanol Storage Tanks VA-7000 and T-132, Dilute Isopropanol Storage Tank T-508, and Isopropanol Distillate Storage Tanks T-135 and T-142 combined; 0.30 ton/yr for VOC emissions of sec-butyl alcohol from sec-Butyl Alcohol Storage Tank T-129; and 0.10 ton/yr for VOC emissions of ethyl acetoacetate from Ethyl Acetoacetate Storage Tank T-131. No controls are necessary in order to achieve any of these VOC emission limitations.

The emissions of hydrogen chloride from the hydrochloric acid storage tank are subject to Rule 23. Control of these emissions by a scrubber has been determined to be reasonable and proper, in accordance with Rule 23. An appropriate reasonable and proper limitation for the emissions of hydrogen chloride from the hydrochloric acid storage tank is 0.20 ton/yr.

Emission Unit 013 Johnston and York-Shipley Boilers and Power Flame Thermal-Fluid Heater

Rated capacities are 10.0 MMBtu/hr for the Johnston boiler, 25.15 MMBtu/hr for the York-Shipley boiler, and 2.0 MMBtu/hr for the Power Flame thermal-fluid heater. 120,154 MMBtu of natural gas were burned in the two boilers and heater combined during the twelve-month period from June 1, 2024, through May 31, 2025. Natural gas has average and maximum sulfur contents of 0.002 gr/ft^3 and 0.005 gr/ft^3, respectively.

The estimated emissions of PM, NO_X, CO, VOC, SO_2, and GHG (actual and CO_2e) that result from natural gas combustion in the two boilers and heater combined are given in Table VII. These emissions, with the exception of emissions of GHG, were calculated by using AP-42 (1998) emission factors. The GHG emissions were calculated by using the Tier 1 calculation methodology that is found in §98.33 of 40 CFR Part 98, Subpart C. The potential emissions are based on continuous operation of the two boilers and heater at their rated capacities while burning natural gas that has the maximum sulfur content. All of the PM emissions that result from burning natural gas are both $PM_{2.5}$ and PM_{10}. According to AP-42 (1998) emission factors, VOC emissions that result from natural gas combustion consist of 32.7% hexane and 1.5% formaldehyde, which are both HAP. GHG emissions that result from natural gas combustion consist mostly of CO_2 and include lesser amounts of methane and nitrous oxide.

The Johnston boiler, York-Shipley boiler, and Power Flame thermal-fluid heater are subject to "National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters," [40 CFR Part 63, Subpart DDDDD (§63.7480–63.7575)], as adopted at Rule 16.5(c). §63.7515(d) and §63.7540(a)(10) of Subpart DDDDD require a performance tune-up of each of the two boilers every year and of the heater every five years. The reporting and recordkeeping requirements are given in §63.7550 and §63.7555 of this subpart.

The Johnston boiler was installed in 1972, and potential PM emissions from it are estimated to be 0.075 lb/hr. The PM emissions from this boiler are limited by Rule 26.6 (RACT) to 0.2888 lb/MMBtu, which is equivalent to 2.89 lb/hr for the boiler while it is operating at its rated capacity. However, Chattem Chemicals previously requested and was granted a more appropriate PM emission limitation of 0.20 lb/hr for this boiler.

The York-Shipley boiler was installed in 2023. It is subject to a recordkeeping provision of "Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units" [40 CFR Part 60, Subpart Dc (§60.40c–60.48c)], as adopted at Rule 15.1. The applicable recordkeeping requirement is given in §60.48c(g) and (i) of Subpart Dc.

Potential PM emissions from the York-Shipley boiler are estimated to be 0.187 lb/hr and 0.82 ton/yr. Therefore, the PM emissions from this boiler are subject to Rule 27.3. An appropriate reasonable and proper limitation, in accordance with Rule 27.3, for these emissions has been previously determined to be 0.20 lb/hr. No controls are necessary in order to achieve this PM emission limitation. This limitation is more stringent than the Rule 8.2 (Schedule 2) PM emission limit of 9.03 lb/hr. This limitation is also more stringent than the Rule 26.6 (RACT) PM emission limit of 0.2888 lb/MMBtu, which, although it is not applicable to the boiler, is equivalent to 7.26 lb/hr for the boiler while it is operating at its rated capacity.

The heater was installed in 1994, and potential PM emissions from it are estimated to be 0.015 lb/hr. Furthermore, the Chattem Chemicals plant is located within the former secondary PM non-attainment area. Therefore, the PM emissions from the heater are subject to BACT [§4-8(e)(2)]. An appropriate BACT limitation for these emissions has been previously determined to be 0.04 lb/hr. No controls are necessary in order to achieve this PM emission limitation. This limitation is more stringent than the Rule 8.2 (Schedule 2) PM emission limit of 1.20 lb/hr. This limitation is also more stringent than the Rule 26.6 (RACT) PM emission limit of 0.2888 lb/MMBtu, which, although it is not applicable to the heater, is equivalent to 0.58 lb/hr for the heater while it is operating at its rated capacity.

Combustion of natural gas with the maximum sulfur content in the two boilers and heater at their rated capacities results in potential SO_2 emissions of 0.014 lb/hr for the Johnston boiler, 0.035 lb/hr for the York-Shipley boiler, and 0.0028 lb/hr for the heater. These SO_2 emission rates are the effective SO_2 emission limitations for the respective pieces of fuel-burning equipment. These limitations are more stringent than the Rule 13.2 SO_2 emission limit of 4 lb/MMBtu, which is equivalent to 40.0 lb/hr for the Johnston boiler, 100.6 lb/hr for the York-Shipley boiler, and 8.0 lb/hr for the heater.

The VOC emissions from the York-Shipley boiler and the heater are subject to BACT (Rule 25.3). It has been determined that no controls are necessary in order to satisfy BACT for these emissions, and no quantitative BACT VOC emission limitations are necessary. No VOC emission limitation is applicable for the Johnston boiler. Furthermore, no limitations are applicable for the emissions of NO_X, CO, and GHG from the two boilers and heater.

Table VII. Plant-Wide Emissions Resulting from Fuel Combustion

Pollutant and Source	Actual Emissions *tons/yr*	Potential Emissions *lb/hr*	Potential Emissions *tons/yr*	Allowable Emissions *lb/hr*
Particulate Matter ($PM_{2.5}$, PM_{10}, and Total)				
Spray Dryer (006)	0.0033	0.010	0.042	*
Two Boilers and Heater (013)	0.448	0.277	1.212	0.44
Total PM	**0.451**	**0.286**	**1.254**	**n/a**
Nitrogen Oxides (NO_X)				
Spray Dryer (006)	0.060	0.173	0.759	0.17
Two Boilers and Heater (013)	6.125	3.788	16.591	n/a
Total NO_X	**6.185**	**3.961**	**17.350**	**n/a**
Carbon Monoxide (CO)				
Spray Dryer (006)	0.048	0.140	0.613	n/a
Two Boilers and Heater (013)	4.948	3.059	13.400	n/a
Total CO	**4.996**	**3.199**	**14.013**	**n/a**
Volatile Organic Compounds (VOC)				
Spray Dryer (006)	0.0032	0.0092	0.040	†
Two Boilers and Heater (013)	0.324	0.200	0.877	n/a
Total VOC	**0.327**	**0.209**	**0.918**	**n/a**
Sulfur Dioxide (SO_2)				
Spray Dryer (006)	0.00033	0.0024	0.010	0.0024
Two Boilers and Heater (013)	0.034	0.052	0.228	0.052
Total SO_2	**0.034**	**0.054**	**0.238**	**0.054**
Actual Greenhouse Gases (GHG)				
Spray Dryer (006)	68.609	198.865	871.031	n/a
Two Boilers and Heater (013)	7,027.8	4,345.8	19,034.6	n/a
Total GHG	**7,096.4**	**4,544.7**	**19,905.6**	**n/a**
Greenhouse Gases (GHG) as Carbon Dioxide Equivalents (CO_2e)				
Spray Dryer (006)	68.678	199.067	871.912	n/a
Two Boilers and Heater (013)	7,034.9	4,350.2	19,053.800	n/a
Total CO_2e	**7,103.6**	**4,549.3**	**19,925.8**	**n/a**

*Included in process PM emission limitation of 0.020 gr/dscf (0.34 lb/hr)

†Included in process VOC emission limitation of 29.0 tons/yr

Summary

The aluminum isopropoxide and aluminum sec-butoxide production process (Emission Unit 003) and the aluminum derivatives production process (Emission Unit 005) are subject to and in compliance with §4-41, Rule 12 (odor) and Rule 25.3 (BACT VOC emissions) and §4-68(d) (compliance assurance monitoring) of the Chattanooga Air Pollution Control Ordinance (the Ordinance).

The aluminum isopropoxide drumming operation (Emission Unit 004) is subject to and in compliance with §4-41, Rule 12 (odor), Rule 25.3 (BACT VOC emissions), and Rule 27.3 (reasonable and proper PM and visible emissions) of the Ordinance.

The aluminum monoacetate spray dryer (Emission Unit 006) is subject to and in compliance with §4-41, Rule 2 (NO_X emissions), Rule 12 (odor), Rule 13 (SO_2 emissions), and Rule 26.13 (RACT PM and visible emissions from pharmaceutical plants) of the Ordinance.

The glycine production process (Emission Unit 008) is subject to and in compliance with §4-41, Rule 12 (odor), Rule 16.5(c) ("National Emission Standards for Hazardous Air Pollutants From the Synthetic Organic Chemical Manufacturing Industry," Title 40 *Code of Federal Regulations* Part 63, Subpart F; "National Emission Standards for Hazardous Air Pollutants From the Synthetic Organic Chemical Manufacturing Industry for Process Vents, Storage Vessels, Transfer Operations, and Wastewater," Title 40 *Code of Federal Regulations* Part 63, Subpart G; and "National Emission Standards for Hazardous Air Pollutants for Equipment Leaks and Fenceline Monitoring for All Emission Sources," Title 40 *Code of Federal Regulations* Part 63, Subpart H), Rule 23 (reasonable and proper gaseous emissions), Rule 25.3 (BACT VOC emissions), and Rule 25.27 (VOC emissions from the manufacture of synthesized pharmaceutical products) and §4-68(d) (compliance assurance monitoring) of the Ordinance.

The Hamposyl® production process (Emission Unit 009) is subject to and in compliance with §4-41, Rule 12 (odor) and Rule 25.3 (BACT VOC emissions) of the Ordinance.

The 8-bromotheophylline production process (Emission Unit 010) is subject to and in compliance with §4-41, Rule 12 (odor), Rule 16.5(c) ("National Emission Standards for Pharmaceuticals Production," Title 40 *Code of Federal Regulations* Part 63, Subpart GGG), Rule 25.3 (BACT VOC emissions), Rule 25.27 (VOC emissions from the manufacture of synthesized pharmaceutical products), and Rule 27.3 (reasonable and proper PM and visible emissions) of the Ordinance.

The specialty pharmaceuticals production process (Emission Unit 011) is subject to and in compliance with §4-41, Rule 12 (odor), Rule 16.5(c) ("National Emission Standards for Hazardous Air Pollutants for Equipment Leaks and Fenceline Monitoring for All Emission Sources," Title 40 *Code of Federal Regulations* Part 63, Subpart H and "National Emission Standards for Pharmaceuticals Production," Title 40 *Code of Federal Regulations* Part 63, Subpart GGG), Rule

23 (reasonable and proper gaseous emissions), Rule 25.3 (BACT VOC emissions), and Rule 25.27 (VOC emissions from the manufacture of synthesized pharmaceutical products) of the Ordinance.

The raw-material and solvent storage tanks (Emission Unit 012) are subject to and in compliance with §4-41, Rule 12 (odor), Rule 23 (reasonable and proper gaseous emissions), and Rule 25.3 (BACT VOC emissions) of the Ordinance.

The Johnston boiler (Emission Unit 013) is subject to and in compliance with §4-41, Rule 3 (visible emissions), Rule 12 (odor), Rule 13.2 (SO_2 emissions), Rule 16.5(c) ("National Emission Standards for Hazardous Air pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters," Title 40 *Code of Federal Regulations* Part 63, Subpart DDDDD), and Rule 26.6 (RACT PM emissions from fuel-burning equipment) of the Ordinance.

The York-Shipley boiler (Emission Unit 013) is subject to and in compliance with §4-41, Rule 12 (odor), Rule 13.2 (SO_2 emissions), Rule 15.1 ("Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units," Title 40 *Code of Federal Regulations* Part 60, Subpart Dc), Rule 16.5(c) ("National Emission Standards for Hazardous Air pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters," Title 40 *Code of Federal Regulations* Part 63, Subpart DDDDD), Rule 25.3 (BACT VOC emissions), and Rule 27.3 (reasonable and proper PM and visible emissions) of the Ordinance.

The Power Flame thermal-fluid heater (Emission Unit 013) is subject to and in compliance with §4-8(e)(2) (BACT PM and visible emissions) and §4-41, Rule 12 (odor), Rule 13.2 (SO_2 emissions), Rule 16.5(c) ("National Emission Standards for Hazardous Air pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters," Title 40 *Code of Federal Regulations* Part 63, Subpart DDDDD), and Rule 25.3 (BACT VOC emissions) of the Ordinance.