Bay Area Air Quality Management District

939 Ellis Street
San Francisco, CA 94109

Proposed Amendments

Regulation 8 Rule 10: Process Vessel Depressurization

Control Measure SS-17

Draft Staff Report

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I. EXECUTIVE SUMMARY

The Bay Area 2001 Ozone Plan Control Measure SS-17, Process Vessel Depressurization proposed amendments to Bay Area Air Quality Management District (BAAQMD) Regulation 8, Rule 10 to require more stringent controls on emissions from the depressurization of process vessels at refineries and chemical plants. These vessels process hydrocarbons and other materials, often under pressure. The vessels require periodic maintenance and repairs that may involve entry by plant personnel. To make a vessel safe for entry, it must be purged of the hydrocarbons and other materials it contains. This requires great care in order to minimize any risk of explosion or risk to personnel. Typically, hydrocarbons are swept from a vessel by purge gas until the hydrocarbon content is well below the level at which there is any risk that an explosive atmosphere would result if air enters the vessel. Once this level is reached, air is used to sweep remaining vapors from the vessel. Personnel may then enter the vessel to perform repairs or maintenance.

These proposed amendments to Regulation 8, Rule 10 will implement Control Measure SS-17 by prohibiting venting to the atmosphere unless the total organic compounds are reduced to a concentration of less than 10,000 parts per million (ppm), expressed as methane (C_1). This control measure may help reduce significant releases of pollutants, including toxic compounds. Staff has identified a potential reduction of 1 ton per day (tpd) of precursor organic compounds.

Staff examined present regulatory requirements and industry standard practices. In addition, various methods to measure emissions of organic compounds (VOC) from vessel depressurization at refineries and chemical plants located in the Bay Area were examined. This proposal will expand the number of vessels covered by this rule, clarify applicability, amend the definitions to reflect updated codes, delete the provision with expired increments of progress, and add specifications for monitoring and records.

Pursuant to the California Environmental Quality Act (CEQA), the District will prepare an initial study to determine the potential environmental impacts of the proposed amendments to Regulation 8, Rule 10, Process Vessel Depressurization.

II. BACKGROUND

A. Emission Source

Periodic maintenance and repair of process equipment are essential to refinery and chemical plant operations. A major phase of the maintenance program includes shutting down and starting up various process units, typically called a turnaround. The procedure for shutting down a unit varies from refinery to refinery and from unit to unit. In general, shutdowns are effected by first shutting off the heat supply to the unit and circulating the feedstock through the unit as it cools. Gas oil may be blended into the feedstock to prevent solidification as the temperature drops. The cooled liquid is then pumped out to storage facilities, leaving hydrocarbon vapors in the unit. The pressure of the hydrocarbon vapors in the unit is reduced by evacuating the various components to a disposal facility such as a fuel gas system, a vapor recovery system, or flare system. The residual hydrocarbons remaining in the unit after depressuring are purged out with steam, nitrogen, and or water. Any purged gases should be discharged to the disposal facilities. Condensed steam and water effluent that may be contaminated with hydrocarbon or malodorous compounds during purging should be handled by closed water treatment systems.[1] Once the unit has been purged, air is then used to sweep out any remaining process gases so that personnel may safely enter the unit.

A survey was conducted to determine the methods presently used for depressuring vessels. Chemical plants listed in the District databank were screened to determine the applicability of the existing rule. These facilities were determined to be exempt form the current regulation. This is clarified in the proposed Section 100 exemptions. The five Bay Area refineries were visited, participated in workgroup meetings, and submitted site-specific depressurization methods. Although procedures are specific for the various process units, there are general procedures that are similar for various units, and consistent with those discussed above. The general understanding of the current rule was to require blowdown to fuel gas recovery and/or a flare, depressurize to less 4.6 pounds per square inch gauge (psig), and measure hydrocarbon concentration to estimate emissions and report to the District. The current rule actually provides four options for compliance with only one limiting the partial pressure of organic compounds to less than 4.6 psig prior to opening the vessel. The proposed amendments, which are discussed below in Section III will clarify the new requirements.

B. Rule Development History

Regulation 8, Rule 10 was adopted by the BAAQMD Board of Directors on March 17, 1982 and amended July 20, 1983. It is intended to limit emissions of precursor organic compound from depressurizing a process vessel during unit turnarounds. It requires that organic compounds, after passing through a knockout pot to remove the condensable fraction, must be (1) recovered and combusted in the fuel gas system, (2) controlled and piped to an appropriate firebox or incinerator, (3) flared, or (4) contained and treated, with venting to the atmosphere prohibited until the partial pressure of organic compounds in the vessel is less than 1000 mm Hg (4.6 psig). Emission reductions from the implementation of the initial rule were estimated by the Air Resource Board at over 17 tons of organics per year.[2]

In attainment plans for the state ozone standard (Clean Air Plans) from 1991 to 2000, the District included Control Measure C4: Improved Process Vessel Depressurization Rule. The measure originally focused on the control efficiency of the means used to reduce emissions during depressurization to the pressure limit at which a vessel may be opened to the atmosphere (4.6 psig). The measure proposed that carbon adsorption with a control

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[1] Air Pollution Engineering Manual
[2] Bay Area '91 Clean Air Plan, Vol. III, Appendix G, Control Measure # C4.

efficiency of 95% is used. It also proposed that compressor capacity for the flare gas recovery systems be sufficient to recover flows from vessels during depressurization, thereby also reducing flaring.[3] The proposal was revised for the Bay Area 2000 Clean Air Plan to require abatement of emissions to continue below the pressure limit in the current rule to an unspecified lower pressure or concentration.[4]

Control Measure SS-17, Process Vessel Depressurization was included in the 2001 Ozone Attainment Plan for the national ozone standard. The measure is identical to Control Measure C4 from the 2000 Clean Air Plan. The measure identified 0.14 tons per day of precursor organic emissions available for reduction. The proposal estimated a reduction of 0.07 tons per day to be achieved by a concentration standard or a reduction in the allowable pressure prior to opening the vessel to atmosphere. The proposed amendments includes a prohibition on venting to atmosphere unless the total organic compounds prior to release are reduced to a concentration of less than 10,000 ppm, expressed as methane.

C. Purpose of Proposed Regulation

The proposed amendments to Regulation 8, Rule 10, Process Vessel Depressurization, are intended to implement Control Measure SS-17 from the Bay Area 2001 Ozone Attainment Plan. The purpose is to limit the amount of total organic compounds emitted to the atmosphere after a process vessel is cleaned and depressured.

D. Means for Monitoring Emissions

The method for monitoring emissions is driven by either Section 8-10-301.4 partial pressure of hydrocarbon less than 4.6 psig or conditions specified on the permit for confined space entry, typically 10% of the lower explosive limit (LEL). To determine the partial pressure of hydrocarbons in the vessel a sample is collected then analyzed by gas chromatography. Confined space entry standards, OSHA regulation 29CFR1910.146 require the internal atmosphere be tested with a calibrated, direct-reading instrument for oxygen content, flammable gases, and toxic air contaminants. These checks are typically done using LEL meters which provide the percent LEL and oxygen level in the atmosphere. Other sensors may be used including carbon monoxide, hydrogen sulfide, etc.. Most manufacturers suggest the meters be calibrated using a known methane or pentane standard. However, a previous National Institute for Occupational Safety and Health (NIOSH) study found that manufacturer-recommended calibration techniques do not match instrument performance when monitoring jet fuel vapors. JP-8 and Jet-A fuels are generally C9 to C16 compounds. Because most LEL meters are calibrated against n-alkanes less than C9, some meters may underestimate the explosive potential of jet fuel vapor in tanks after removal of the most volatile components.[5]

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[3] Bay Area '91 Clean Air Plan, Vol. III, Appendix G, Control Measure # C4.
[4] Bay Area 2000 Clean Air Plan, Control Measure # C4.

[5] FIELD-PRODUCED JP-8 STANDARD FOR CALIBRATION OF LOWER EXPLOSIVE LIMIT METERS USED BY JET FUEL TANK MAINTENANCE PERSONNEL. S. Martin, P. Jensen, NIOSH, Morgantown, WV; J. Pleil, US EPA, Research Triangle Park, NC

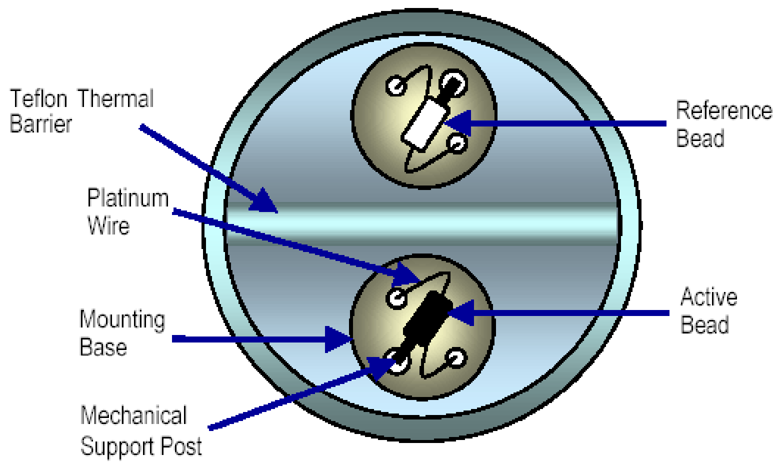

Fig. 1 Catalytic Bead Sensor

The principle of operation of an instrument measuring % LEL is called catalytic oxidation. When exposed to a mixture containing gases and oxygen, the measuring bead coating allows the oxygen and combustibles to combine at its surface, Figure 1. The energy produced by this reaction heats the measuring bead. The rise in temperature changes the bead's resistance and is related to the concentration of the combustible gas. This rise in temperature is generated by a constant-current supplied to the sensor. The sensor signal readout is indicated as percent LEL. The catalyst employed in these sensors is critical to the accuracy and life of the sensor, and impacts the variety of combustible gases the sensor can detect.

Although catalytic bead sensors have been in use for decades, the technology has some drawbacks. A main drawback is the inability to operate in an environment deficient in oxygen since the bead requires efficient oxidation of hydrocarbon gas. Oxygen levels impact oxidation efficiency and hence, the sensor's accuracy. Another drawback is sensor poisoning by chemical compounds such as silicones and sulfur compounds leading to a decline in catalytic activity. Contamination can show up during normal maintenance of the system as an increase in the response time to calibration, recovery time after exposure and loss of exposure response. Since these conditions can occur without warning to the operator, electrocatalytic hydrocarbon sensors are not fail-to-safe; fail-to-safe in this instance implies the sensor's ability to communicate its dysfunctional status to the operator. Catalytic sensors are still the sensors of choice when it comes to operating the sensor head above 75°C.

Hydrocarbon sensors based on infrared (IR) absorption principles do not suffer from the drawbacks of catalytic bead sensors. This leads to increased reliability and a hydrocarbon monitoring system that can operate maintenance free for years. IR absorption based instruments offer fail-to-safe operation because the optical technology is an active one, able to communicate the sensor's status and faults to the operator.

The IR method of measuring gas concentration is based on the absorption of IR radiation at certain wavelengths as the radiation passes through a volume of the gas. IR hydrocarbon gas detectors can be classified into two types known as point detectors and open path detectors. For point detectors, the absorption path length is fixed, and is determined by the instrument design to be a few inches. For the open path IR detectors, the absorption path length can be as long as 100 meters as opposed to the few inches of the point detector.

Instruments based on IR technology use two wavelengths, one at the gas-absorbing wavelength and the other at a wavelength not absorbed by the gas. IR gas sensing technology provides for fail-to-safe operation in contrast to electrocatalytic sensors since optical sensing is an active technology, which continuously monitors for sensor faults and communicates them to the user. This is achieved chiefly through the use of the second or reference wavelength. IR detectors are immune to poisoning, resistant to corrosion, operate in a deficit or surplus oxygen atmosphere, and have no reduction in sensor life from repeated exposure to gas. With the sophisticated optical and electronic designs currently used, the detectors are factory calibrated and virtually maintenance free. This is particularly desirable when sensors must be located in inaccessible areas and cannot be easily calibrated on a periodic basis.[6]

With flame ionization technology, the sample gas is mixed with a fuel (normally hydrogen) and burned in an atmosphere of “blanket air”. The hydrogen delivery system provides a precise flow to the detector. Sample gathering is done by using a small diaphragm air pump. The sample delivery system provides air to the detector chamber to maintain the flame combustion and introduce the organic air contaminants for analysis. The ions formed in the burning process cause an electrical conduction between two electrodes in the combustion chamber (or detector cell) that is amplified by a highly sensitive electrometer-amplifier circuit. The electrical output of the electrometer-amplifier is directly proportional to the quantity of flame ionizable hydrocarbons present, and is linear over a wide range. Figure 2 illustrates both the hydrogen flow and air flow patterns in the OVA 128.

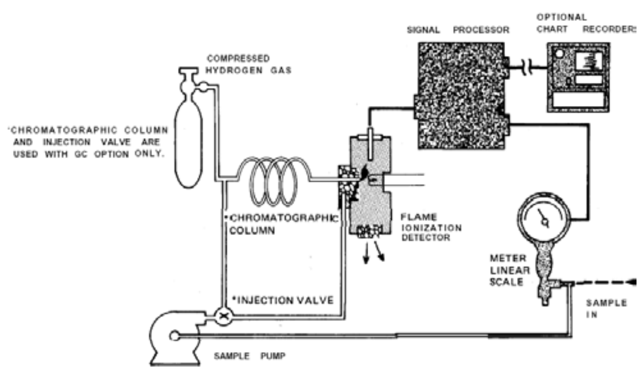

Figure 2 OVA 128[7]

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[6] INFRARED TECHNOLOGY FOR FAIL-TO-SAFE HYDROCARBON GAS DETECTION, Dr. Shankar Baliga, Senior Development Scientist, General Monitors

[7] Century OVA 128 Portable Hydrocarbon Analyzer Product Specification Brochure

Staff considered three technologies to monitor the emissions from depressured vessels. Table 1 suggests some advantages and disadvantages of each technology. The proposed amendments specify the use of a meter that meets the accuracy requirements of EPA Method 21.

Table 1: Monitoring Technology Comparision

TECHNOLOGY	ADVANTAGE	DISADVANTAGE
Catalytic detectors	Robust	Catalysts can become poisoned or inactive due to contamination
	Simple to operate	The only means of identifying detector sensitivity loss due to catalytic poisons is by checking with the appropriate gas on a routine basis and recalibrating as required.
	Easy to install, calibrate and use	Requires oxygen for detection.
	Long lived with a low life-cycle cost	Prolonged exposure to high concentrations of combustible gas may degrade sensor performance.
	Proven technology currently in use by refiners.	
Flame ionization	Universal organic compound response with approximately the same high sensitivity for all	The initial cost is higher than catalytic detectors.
	Flame ionization will not respond to changes in relative humidity or changes in CO and CO2 concentration.	More difficult to calibrate and maintain than catalytic detectors.
	It is a mass sensing detector which exhibits minimal effects from changes in temperature, pressure, or flow.	High maintenance cost compared to catalytic detectors.
	Provides excellent dynamic range and concentration linearity.	Requires a fuel source.
Infrared	High resistance to contamination and poisoning	The initial higher cost per point. IR detectors in the past have been more expensive than catalytic detectors at initial purchase, but they are rapidly coming down in price to cost parity with catalytic detectors.
	Fail-to-safe operation	Higher spare parts cost.
	Ability to operate in the absence of oxygen or in enriched oxygen	The gas to be measured must be infrared active, such as a hydrocarbon.
		Gases that do not absorb IR energy (such as hydrogen) are not detectable.
		High humidity, dusty and/or corrosive field environments can increase IR detector maintenance costs.
		Routine calibration to a different gas is not practical.
		A relatively large volume of gas is required for response testing.
		Does not perform well for multiple gas applications.
		Cannot replace the IR source in the field – must be returned to factory for repair.

III. PROPOSED RULE

The proposed amendments to Regulation 8, Rule 10, Process Vessel Depressurization would replace the existing control options with a concentration standard. The existing industry standard operating procedures already limit emissions beyond the level required by the present rule. This proposal will eliminate these options. A new provision will add a requirement to measure total organic compounds initially and once each per 24-hour period the vessel is open. Monitoring and recording requirements are added to reflect these changes. Table 2 is a summary of the proposed amendments.

Table 2: Summary of Proposed Amendments

REGULATION SECTION #	DESCRIPTION
8-10-110	Adds an exemption for sources subject to other rules including: Regulation 8, Rule 24, Pharmaceutical And Cosmetic Manufacturing Operations; Regulation 8, Rule 35, Coating, Ink And Adhesive Manufacturing; Regulation 8, Rule 36, Resin Manufacturing; Regulation 8, Rule 41, Vegetable Oil Manufacturing; Regulation 8, Rule 50, Polyester Resin Operations; Regulation 8, Rule 52, Polystyrene, Polypropylene And Polyethylene Foam Product Manufacturing.
8-10-111	Deletes the exemption for chemical plants due to expired increments of progress.
8-10-202	Updates the definition of a petroleum refinery to reflect the proper classification number.
8-10-204	Expands the definition of process vessels to include other containers.
8-10-205	Adds a definition for total organic compounds.
8-10-301	Adds an emission limitation on vessel ventings.
8-10-400	Relocates record elements to Section 500 and deletes the expired increments of progress for chemical plants.
8-10-501	Adds monitoring protocols.
8-10-502	Adds specifications for records.
8-10-503	Adds a monthly reporting requirement.
8-10-601	Adds accuracy requirements for monitoring.

Discussion of Proposed Language

Exemptions

8-10-101 ***Description:*** *The purpose of this Rule is to limit emissions of total ~~precursor~~ organic compounds from venting process vessels to the atmosphere ~~depressurization~~ at petroleum refineries and chemical plants.*

The proposed changes describe the intent to limit the amount of total organic emissions vented to the atmosphere. This reflects the change from specifying options to handle materials from vessel depressurization.

8-10-110 ***Exemption, Equipment Subject to Other Rules*** ~~***Storage Vessels:***~~ ~~*The requirements of Section 8-10-301 shall not apply to stationary containers used solely for the storage of an organic liquid.*~~ *The provisions of this rule shall not apply to vessels that are subject to the following Regulation 8 rules;*

110.1 Regulation 8, Rule 5, Storage of Organic Liquids.
110.2 Regulation 8, Rule 24, Pharmaceutical And Cosmetic Manufacturing Operations.
110.3 Regulation 8, Rule 35, Coating, Ink And Adhesive Manufacturing.
110.4 Regulation 8, Rule 36, Resin Manufacturing.
110.5 Regulation 8, Rule 41, Vegetable Oil Manufacturing Operations.
110.6 Regulation 8, Rule 50, Polyester Resin Operations.
110.7 Regulation 8, Rule 52, Polystyrene, Polypropylene And Polyethylene Foam Product Manufacturing Operations.

Sections 8-10-110 exemptions are proposed for adoption to eliminate duplication of standards for vessels under the jurisdiction of existing District regulations. The California Health & Safety Code requires that any amendments or proposals to a rule must be nonduplicative. The exemptions reference the appropriate existing District regulation for the specific source operation.

The exemption in Section 8-10-111 for chemical plants is proposed for deletion due to expired increments of progress.

Definitions

8-10-202 ***Petroleum Refinery:*** ~~*Any facility engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, lubricants or other products through distillation of petroleum or through redistillation, cracking, rearrangement or reforming of unfinished petroleum derivatives.*~~*A facility that processes petroleum, as defined in the North American Industrial Classification Standard No. 32411 (1997).*

Section 8-10-202: The Standard Industrial Classification (SIC) code, established by the Bureau of Census to track the flow of goods and services within the economy, is a statistical classification standard used for all establishment-based Federal economic statistics. The SIC codes facilitate comparisons between facility and industry data. The petroleum refining industry was classified as SIC 2911, which includes the production of petroleum products through distillation and fractionation of crude oil, redistillation of unfinished petroleum derivatives, cracking, or other processes.[8] The SIC code system was replaced by the North American Industrial Classification Standard (NAICS). NAICS was developed jointly by the U.S., Canada, and Mexico to provide new comparability in statistics about business activity across North America. The proposed amendment for Section 202 is to change the code number to the NAICS classification #32411 for petroleum refineries.

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[8] EPA Sector Notebook, 1995

8-10-204 ***Process Vessel:*** *Any vessel in which organic compounds are fractionated ~~on more than one tray or on packing~~, ~~or~~ chemically reacted, ~~or~~ washed or purified. These vessels include reactors, columns, accumulator vessels, knockout pots, surge/settling drums and other similar devices that are greater than 10 cubic feet (ft^3).*

The definition of process vessel is proposed to be expanded to include other containers that have the potential to emit total organic compounds. These vessels were not subject to the existing depressurization standard, are typically smaller in size than regulated vessels, however their numbers are greater.

8-10-205 ***Total Organic Compounds:*** *All organic compounds of carbon including methane, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates and ammonium carbonate, that would be emitted to the atmosphere.*

This definition was added to clarify the intent to include methane as a regulated compound.

Standards

8-10-301 ***Limit~~Process Vessel Depressurizing~~:*** *~~The control of precursor organic compounds emissions from depressurizing any~~ A process vessel ~~at a petroleum refinery or a chemical plant during a process unit turnaround~~ shall not be vented to the atmosphere~~accomplished so that the, after passing through a knockout pot to remove the condensable fraction, must either be~~ unless the total organic compounds prior to release to the atmosphere are reduced to a concentration of less than 10,000 parts per million (ppm), expressed as methane (C_1).*

~~301.1 Recovered (add to the fuel gas system) and combusted,~~

~~301.2 Controlled and piped to an appropriate firebox or incinerator for combustion,~~

~~301.3 Flared,~~

~~301.4 Contained and treated so as to prevent their emissions to the atmosphere. Such procedures shall continue until the pressure within the process vessel is as close to atmospheric pressure as practicably possible, in no case shall a process vessel be vented to the atmosphere until the partial internal pressure of organic compounds in that vessel is less than 1000 mm Hg (4.6 psig).~~

Section 8-10-301: This section establishes a limit on the amount of total organic compounds that may be emitted from a process vessel. The existing control options are proposed to be replaced with a prohibition of venting to atmosphere until the total organic compounds are reduced to a concentration of less than 10,000 ppm, expressed as methane. Staff considered existing refinery practices and similar District standards to establish the concentration standard.

Refinery practices for entering vessels are guided by Occupational Safety And Health Standards, Part 1910, Sec.1910.146 Permit-Required Confined Spaces. The code contains elements required to protect worker health and safety for permit-required confined spaces. It requires an employer to develop an overall program for controlling, and, where appropriate, for protecting employees from permit space hazards and for regulating employee entry into permit spaces program to allow for safe entry into the vessel. One element generally established in the industry is to achieve 10% of the LEL. A list of the LEL of various compounds can be found in the Appendix.

Administrative Requirements

8-10-401 Turnaround Records: *Refinery personnel shall keep records of each process unit turnaround, listing as a minimum:*

401.1 The date of unit shutdown and/or depressurizing,

401.2 The approximate process vessel hydrocarbon concentration when the organic emissions were first discharged into the atmosphere, and

401.3 The approximate quantity of total precursor organic compounds emitted into the atmosphere. These records shall be kept for at least two (2) years and be made available to the APCO during any compliance inspection.

Section 8-10-401: The elements required for records are proposed to be incorporated into the 500 Section of the rule for Monitoring and Records.

8-10-402 Increments of Progress: *A person who must modify existing sources or install new control equipment at chemical plants to comply with the requirements of this Rule shall comply with the following compliance schedule:*

402.1 January 1, 1984: Submit to the APCO final control plan which describes, as a minimum, the steps, including a construction schedule, that will be taken to achieve compliance with such requirements.

402.2 July 1, 1984: Submit a completed application for any Authority to Construct necessary to achieve compliance with such requirements.

402.3 January 1, 1985: Be in compliance with all the requirements of this Rule.

Section 8-10-402: This section is proposed to be deleted due to the expired increments of progress for chemical plants.

Monitoring and Records

8-10-501 Monitoring: *Any vessel subject to this rule shall be monitored for the concentration of total organic compounds prior to opening and once per day during the time the vessel is open to the atmosphere. The sample shall be a representative sample of the internal atmosphere of the vessel.*

Section 8-10-501: This section is proposed to specify the location and frequency for measuring emissions from depressured process vessels. The intent of specifying a location is to insure that a representative sample of the internal atmosphere of the vessel is acquired. The purpose of the increased frequency for measuring emissions is to verify the cleanliness of the vessel and to determine the emissions after one volume change in the vessel. This data will be used for future rule development.

8-10-502 Records: *Any facility subject to the provisions of this rule shall keep records of each vessel depressurization. The records shall include the following information:*

502.1 The date, time, and duration of depressurization,

502.2 The type of service, size and name or vessel identification number,

502.3 The measured total organic compound concentration and calculated mass emissions from each depressured vessel,

502.4 The number and size of any air movers used to assure compliance with confined space entry requirements.

Records shall be maintained for at least 5 years and shall be made available to the APCO for inspection at any time.

Section 8-10-502: This section is proposed to lists the required elements for records. It specifies the information to be tracked including the date, time and duration of the turnaround, vessel identification, the concentration and calculated mass of emissions for the vessel turnaround.

***8-10-503 Reporting**: Any facility subject to the provisions of this rule shall submit a monthly report to the Air Pollution Control Officer (APCO) containing the elements of Section 8-10-502.*

Section 8-10-503: This section is proposed to require a monthly report to be submitted to the APCO.

Manual of Procedures

***8-10-601 Emission Monitoring:** The meter used to measure the concentration of total organic compound emissions shall meet the accuracy requirements of EPA Method 21.*

Section 8-10-601: The specification for monitor accuracy is proposed to be listed in this section. The literature suggests deficiencies with LEL meters when measuring atmospheres with high levels of inert compounds. This condition is typical after vessel depressurization. Other technologies, flame ionization do not have the same level of interference with inerts. LEL meters currently in use cannot meet the accuracy limit specified in EPA Method 21.

IV. EMISSIONS AND EMISSIONS REDUCTIONS

The frequency of turnarounds varies depending on the process unit. The typical time between turnarounds is generally three to four years. Some process units go for as long as ten years between turnarounds. The current rule requires retention of records for two years. This factor limits the data available for analysis. Staff requested records for the prior two years and received information from two of the five refineries. This information was used to determine the quantity of total organics available for reduction, the emissions allowed by the current rule, and the estimated reduction if the 10,000 ppm proposed limit is adopted. Table 3 shows the result of this analysis.

Table 3: Total Organics Actual vs. Potential

REFINERY	REFINERY ESTIMATE (pounds per day)		ALLOWED BY CURRENT RULE[1] (pounds per day)		EMISSIONS WITH PROPOSED AMENDMENTS[2] (pounds per day)	
YEAR	2002	2003	2002	2003	2002	2003
Refinery A	0.56	0.42	386	149	4	1
Refinery B	0.19	0.57	343	737	3	7
Bay Area[3]	1.88	2.5	1,824	2,216	17.5	20

[1] Assuming no clingage, no outgassing, no liquid in vessel

[2] Assumes a molecular weight of 100, a molar volume of 379 cubic feet per pound mole, and 10,000 ppm limit

[3] Assumes 2 of 5 refineries 2 yr data set is representative of the average

V. Economic Impacts

A. Socioeconomic Impacts

Section 40728.5 of the Health and Safety Code requires an air district to assess the socioeconomic impacts of the adoption, amendment, or repeal of a rule if the rule is one that "will significantly affect air quality or emissions limitations." After a final draft rule has been developed and cost impacts are known with greater certainty, the District will prepare this analysis.

B. Incremental Costs

Under Health and Safety Code Section 40920.6, the District is required to perform an incremental cost analysis when adopting a Best Available Retrofit Control Technology (BARCT) rule or feasible measure required by the California Clean Air Act. To perform this analysis, the District must (1) identify one or more control options achieving the emission reduction objectives for the proposed rule, (2) determine the cost effectiveness for each option, and (3) calculate the incremental cost effectiveness for each option. To determine incremental costs, the District must "calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option." The proposed amendments to Regulation 8, Rule 10 are intended to implement Control Measure SS-17 from the Bay Area 2001 Ozone Attainment Plan. and Control Measure C4 from the Bay Area 2000 Clean Air Plan. Because Control Measure C4 is intended to meet feasible measure requirements under the California Clean Air Act, an incremental cost analysis is required.

During the rule development process, two control options have been discussed: (1) a concentration standard that applies to all vessels without exception, and (2) a concentration standard that applies in almost all cases, but with an allowance for a small number of depressurization events to exceed the concentration standard provided documentation requirements are met. The incremental cost analysis is ongoing and will be completed after all cost data has been received and reviewed.

C. Costs

The proposed amendments impose requirements that differ only slightly from existing practice. There are some minor costs associated with a change in monitoring equipment for those facilities that do not currently use flame ionization detectors for surveying emissions from vessel depressurization. Generally, facilities use catalytic detectors to monitor confined space atmospheres. The proposed amendments might require different monitoring equipment. Although flame ionization detectors are used for fugitive surveys, for example to determine compliance with District Regulation 8, Rule 18, Equipment Leaks, some refineries reported that extra staff and training would be required to monitor process vessel depressurization. This would be necessary to insure the proper operation and maintenance of the analyzer, and compliance with the accuracy requirements of Method 21. Industry stated that based on current depressurization procedures show a few vessels would be in violation of the proposed standard. Currently, there is insufficient information available to determine the additional time and methods necessary to meet the standard. An estimate was given based on an additional day of cleaning. Table 4 is staff's estimate of the various cost items that may be imposed by the proposed rule.

Table 4: Cost Estimate

COST ITEM	COST ITEM	COST WITH CONTINGENCY[1]
PPM Hydrocarbon Analyzer[2]	$15,400	$20,020
Records[3]	$360	$468
Maintenance & Calibration[4]	$1,540	$2,002
Monitoring[5]	$22,500	$29,250
Vessel Cleaning[6]	$500,000	$650,000

[1] 30% contingency
[2] Initial purchase price of a flame ionization meter
[3] $30/hr for 12 hours (one hour per month for 12 months)
[4] 10% of equipment purchase price (EPA Cost Manual), Includes Parts and Calibration once per quarter
[5] 300 vessels, annual cost at one half-hour per vessel monitored once per day for 15 days every 3 years at $30/hr
[6] Assumes one day of additional vessel cleaning of one vessel; Dollar amount based on refinery statements made during workgroup meetings.

VI. ENVIRONMENTAL IMPACTS

Pursuant to the California Environmental Quality Act, the District will prepare an initial study for the proposed amendments to determine whether they would result in any significant environmental impacts. It is expected that adoption of the proposed amendments will create environmental benefits from a reduction in emissions of both total and toxic organic compounds.

VII. REGULATORY IMPACTS

California Health and Safety Code Section 40727.2 require the District to identify existing federal air pollution control requirements for the equipment or source type affected by the proposed rule or regulation. The District must then note any differences between these existing requirements and the requirements imposed by the proposed rule. Regulation 8, Rule 10, Process Vessel Depressurization apply to specific vessels in refineries and chemical plants when depressuring a vessel. The proposed amendments expand the applicability to a greater number of process vessels and limit the emissions after depressurization. No federal air pollution control requirement was identified for the equipment or source type affected by the proposed rule or regulation.

VIII. RULE DEVELOPMENT HISTORY

A workgoup was formed that included representatives from California Air Resources Board, Industry, Communities for a Better Environment, and District Staff. The workgroup has met periodically since January 2003 to discuss technical issues. The issues discussed included the definition of process vessel, current methods used to determine emissions to the atmosphere, methods used to clean and purge vessels, interpreting existing data, emission limitations and controls.

IX. DISTRICT STAFF IMPACTS

Implementation of the proposed regulation will have a limited impact on the District's resources. However, these changes are essential and necessary in order to satisfy the commitments in the Bay Area 2001 Ozone Attainment Plan. Staff will need to verify the vessel concentration during turnarounds, review reports and records, and collect and analyze gas samples for selected vessels.

X. REFERENCES

Air Pollution Engineering Manual

FIELD-PRODUCED JP-8 STANDARD FOR CALIBRATION OF LOWER EXPLOSIVE LIMIT METERS USED BY JET FUEL TANK MAINTENANCE PERSONNEL. S. Martin, P. Jensen, NIOSH, Morgantown, WV; J. Pleil, US EPA, Research Triangle Park, NC.

INFRARED TECHNOLOGY FOR FAIL-TO-SAFE HYDROCARBON GAS DETECTION, Dr. Shankar Baliga, Senior Development Scientist, General Monitors

Century OVA 128 Portable Hydrocarbon Analyzer Product Specification Brochure

Control Measure C4, Technical Assessment Document, October 9, 1991

EPA Sector Notebook, 1995

EPA Cost Manual, January 2002

Bay Area 2001 Ozone Attainment Plan, adopted October 24, 2001

Appendix

Flammable Properties

COMPOUND	MOLECULAR WEIGHT	LEL (volume %)	LEL (PPM)	10% LEL (expressed as ppm C_1)
Methane	16.04	5.00	50,000	5,000
Ethane	30.07	3.00	30,000	6,000
Propane	44.09	2.12	21,200	6,360
Butane	58.12	1.86	18,600	7,440
Pentane	72.15	1.40	14,000	7,000
Hexane	86.17	1.18	11,800	7,080
Octane	114.23	0.95	9,500	7,600
Nonane	128.25	0.83	8,300	7,470
Decane	142.28	0.77	7,700	7,700
Ethylene	28.05	2.75	2,750	550
Propylene	42.08	2.00	2,000	600
Acetylene	26.04	2.50	2,500	500
Cyclohexane	84.16	1.26	1,260	756
Benzene	78.11	1.40	1,400	840
Toluene	92.13	1.27	1,270	889