United States Environmental Protection Agency | RCRA Programs Branch | Region IV Atlanta, GA

RCRA Air Rules | 30 October 2000

Guidance Document for RCRA Hazardous Waste Air Emission Standards Under 40 CFR Parts 264 and 265

GUIDANCE DOCUMENT FOR RCRA HAZARDOUS WASTE AIR EMISSION STANDARDS UNDER 40 CFR PARTS 264 AND 265

Implementation of Subpart CC Standards Pressure Relief Device Requirements for Tanks Using Level 1 Controls

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October 30, 2000

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The Subpart CC standards refers to the standards under Subpart CC in both 40 CFR part 264 and 40 CFR part 265 of the Resource Conservation and Recovery Act (RCRA) subtitle C regulations. These standards are aimed at controlling volatile organic air emissions from tanks, surface impoundments, and containers used to manage hazardous waste. This document discusses, specifically, the requirements for tanks which meet the Tank Level 1 Control criteria.

Tanks which use Level 1 Controls and vent to the atmosphere are regulated to control emissions in a manner that prevents continuous venting to the atmosphere. One method of controlling emissions from tanks is the use of a fixed-roof tank to meet Level 1 Controls. Under the Subpart CC RCRA Air Rules, a fixed-roof tank can be equipped with a pressure/vacuum (PV) relief valve. These valves allow vapors to flow in and out of a tank in order to maintain the internal pressure of the tank within operational parameters, while preventing the continuous venting of vapors to the atmosphere.

Because of the variable nature of tanks and tank design, as well as the wide variety of material stored in tanks, Subpart CC does not define specific settings for PV valves. As a result of this, it is up to each owner/operator to determine the pressure settings at which the PV valve will release vapors to the atmosphere. It should be remembered, however, that considering the regulatory intent of the provision, it is reasonable to expect that the set point for a PV device not be set a level so low that the device remains open continuously or most of the time. The regulatory intent of controlling organic emissions from tanks must be balanced with the need to do so in a safe manner.

Several trade and professional organizations have developed standards for fixed-roof tanks. These safety standards can be used to help define appropriate settings for PV devices. This document gives a brief overview of those organizations' various tank standards, most of which are oriented toward safety consideration relative to the tank, and how they may be used to help an owner/operator determine a safe setting for a PV device which would control emissions in accordance with the Subpart CC standards.

Compliance with Subpart CC is determined based on whether or not a good faith effort was made to meet the requirements of Subpart CC. This document will help the user determine what constitutes a good faith effort. Safety, tank structural integrity, and control of emissions are all factors that must be considered when choosing a set point for a PV device. Owners/operators must ensure that they make every effort to meet these three goals in order to achieve their good faith effort and maintain compliance with Subpart CC.

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1.0 Subpart CC Standards: Tank Level 1 Control Requirements

The U.S. Environmental Protection Agency (EPA) promulgated standards under the Resource Conservation and Recovery Act (RCRA) to control volatile organic air emissions from tanks, surface impoundments, and containers used to manage hazardous wastes. These standards are known colloquially as the "Subpart CC standards" because the standards are under Subpart CC in both 40 CFR part 264 and 40 CFR part 265 of the RCRA subtitle C regulations.

The Subpart CC standards apply to owners and operators of tanks at permitted hazardous waste treatment, storage, and disposal facilities (TSDF). These standards apply to owners and operators of tanks at permitted TSDF under 40 CFR part 264, and to owners and operators of tanks at interim status TSDF under 40 CFR part 265. In addition, the Subpart CC standards (in 40 CFR part 265) apply to large quantity generators (LQG) accumulating hazardous waste on-site for less than 90-days in RCRA permit-exempted tanks under 40 CFR 262.34 (a) (commonly referred to under the RCRA program as “90-day tanks”). The technical air emission control requirements for tanks are identical under the Subpart CC standards in both parts 264 and 265.

1.1 What Are the Tank Standards Under Subpart CC?

Tanks are extensively used in the waste management industry for the accumulation, storage, and treatment of RCRA hazardous waste materials at TSDF and LQG. The Subpart CC standards require the implementation of air emission controls on tanks used to manage RCRA hazardous waste having an average volatile organic concentration equal to or greater than 500 parts per million by weight (ppmw), as determined using the test procedures specified in the rule. For these tanks, the Subpart CC standards establish two categories of air emission control requirements, called *Tank Level 1 controls* and *Tank Level 2 controls*.

Tank Level 1 Controls. The hazardous waste must be managed in a covered tank (i.e., a fixed-roof tank).

Tank Level 2 Controls. The hazardous waste must be managed in a tank that uses controls that either suppress the vaporization of the volatile organic components contained in the waste, or capture the organic vapors vented from the tank. The tank owner or operator may choose to comply with any one of five compliance alternatives: 1) use a fixed roof with an internal floating roof; 2) use an external floating roof; 3) vent the tank to an organic vapor control device (e.g., vapor incinerator, carbon adsorber, or condenser): 4) use a pressurized tank that operates as a closed system during normal operating conditions; or 5) locate an open-top tank inside an enclosure vented to a thermal combustion control device.

1.2 Which TSDF and 90-day Tanks Can Use Level 1 Controls?

Whether Tank Level 1 controls or Tank Level 2 controls are required for a given TSDF or 90-day tank is determined by conditions specified in the rule related to the volatile organic emission potential for the tank. A TSDF or 90-day tank that manages RCRA hazardous waste having an average volatile organic concentration equal to or greater than 500 ppmw (determined using the test procedures specified in the rule) and a maximum vapor pressure of less than 76.6 kilopascals (kPa) (approximately 11.1 pounds per square inch (psi)) may qualify to use Tank Level 1 controls. To qualify to use Tank Level 1 controls, a TSDF or 90-day tank must meet all three of the following conditions:

Condition 1: The maximum organic vapor pressure of the hazardous waste in the tank must be less than the cutoff limit specified for the tank's design capacity. The term *maximum organic vapor pressure* is defined in the Subpart CC standards (see §265.1081). A cutoff limit is specified for each of three categories of tank sizes (see §264.1084(b)(1) and §265.1085(b)(1)). The *maximum organic vapor pressure* cutoff limits by tank size category are summarized in the table presented below.

If the tank design capacity is . . .	Then the *maximum organic vapor pressure* of the hazardous waste in the tank must be less than . . .
151 m^3 or greater (approximately 40,000 gallons)	5.2 kPa (approximately 0.75 psi)
75 m^3 or greater but less than 151 m^3	27.6 kPa (approximately 4.5 psi)
less than 75 m^3 (approximately 20,000 gallons)	76.6 kPa (approximately 11.1 psi)

Condition 2: No heating of the waste in the tank to temperatures greater than a temperature at which the *maximum organic vapor pressure* was determined by the procedures specified in the rule.

Condition 3: No waste stabilization process is performed in the tank. The term *waste stabilization process* is defined in the Subpart CC standards (see §265.1081).

1.3 What Are the Tank Level 1 Equipment Requirements?

A TSDF or 90-day tank using Tank Level 1 controls is required to be covered using a *fixed-roof*. A fixed roof, as defined for the Subpart CC standards, means a cover that is mounted on a tank in a stationary position and does not move with fluctuations in the level of the liquid managed in the tank (see §265.1081). The specific control requirements for a fixed-roof tank that the owner or operator must comply with are specified in part 264 under §264.1084(c)(3) and in part 265 under §265.1085(c)(3). These requirements are identical in both parts 264 and 265, and can be summarized as:

- The tank fixed-roof must be designed with no visible cracks, holes, gaps or other open spaces in roof seams and mountings.

- Each opening on the fixed-roof must be either: 1) equipped with a closure device designed with no visible cracks, holes, gaps or other open spaces when secured in closed position, or 2) connected by a closed-vent system to a control device.

- Each closure device on the fixed-roof must be maintained in a closed position except when necessary to access the waste contained in the tank or to access equipment inside the tank under the cover

- Vapors and gases may be vented from inside the tank directly to the atmosphere using appropriate devices when necessary to maintain the tank internal pressure within the tank design specifications.

In the situation when a given TSDF or 90-day tank qualifies to use Tank Level 1 controls but the tank owner or operator prefers to use another type of control other than a fixed-roof, the owner or operator may elect to comply with the Subpart CC standards using one of the compliance alternatives allowed by the Tank Level 2 control requirements.

1.4 When is Venting (to the Atmosphere) of a Tank Using Level 1 Controls Allowed?

An owner or operator implementing the Tank Level 1 control requirements under the Subpart CC standards may vent a fixed-roof tank directly to the atmosphere during the following situations:

Normal venting. The fixed-roof tank may vent through an appropriate pressure relief device to the atmosphere at those times necessary during normal operations to maintain the tank internal pressure within the tank design specifications. A *pressure-vacuum relief valve* or similar type of pressure relief device must be used and operated following requirements specified in the rule.

Emergency venting. The fixed-roof tank may vent through a *safety device* directly to the atmosphere any time needed to prevent physical damage or permanent deformation to equipment by venting gases or vapors during unsafe conditions resulting from an unplanned, accidental, or emergency event. This safety device is not used for venting of gases or vapors from the tank during normal operations.

1.5 What Are the Venting Requirements During Normal Operations?

The fixed-roof tank venting requirements for normal operations are specified under the Tank Level 1 control requirements in §264.1084(c)(3)(ii) and in §265.1085(c)(3)(ii). The rule language used for this provision is identical in both parts and reads as follows:

"*Opening of a spring-loaded pressure-vacuum relief valve, conservation vent, or similar type of pressure relief device which vents to the atmosphere is allowed during normal operations for the purpose of maintaining the tank internal pressure in accordance with the tank design specifications. The device shall be designed to operate with no detectable organic emissions when the device is secured in the closed position. The settings at which the device opens shall be established such that the device remains in the closed position whenever the tank internal pressure is within the internal pressure operating range determined by the owner or operator based on the tank manufacturer recommendations, applicable regulations, fire protection and prevention codes, standard engineering codes and practices, or other requirements for the safe handling of flammable, combustible, explosive, reactive, or hazardous materials. Examples of normal operating* *conditions that may require these devices to open are during those times when the container internal pressure exceeds the internal pressure operating range for the tank as a result of loading operations or diurnal ambient temperature fluctuations.*"

This provision addresses venting of a fixed-roof tank during normal operations (i.e., normal venting). The provision does not apply to venting of the tank during emergency situations (i.e., emergency venting). Normal operations are considered to be those day-to-day events that require routine venting of the organic vapors from the vapor headspace inside the tank. Examples of such events are: 1) venting vapors from the tank headspace when the tank is being filled with waste; and 2) venting vapors from the tank headspace to adjust the tank's internal pressure in response to diurnal ambient temperature and pressure fluctuations. The provision allows the tank owner or operator to use a pressure-vacuum (PV) relief valve (or similar type of pressure relief device) to vent the vapor headspace of the tank directly to the atmosphere only when it is necessary to protect the tank's structural integrity. The pressure relief device cannot be continuously open to the atmosphere (i.e., open vents on the tank are prohibited).

A pressure-vacuum relief valve used on a tank for normal venting is often called a "*conservation vent*." The provision also allows a pressure relief device other than a pressure-vacuum relief valve to be used. No matter the term used for the pressure relief device, the device used to comply with this provision must be designed to open and close in response to pressure changes. The device must effectively seal the vent opening (as measured by no detectable organic emissions) when the device is secured in the closed position. The device can only be in the open position when the internal pressure, or another relevant parameter, exceeds the device pressure threshold setting applicable to the tank as determined by the owner or operator. Otherwise, the device must remain in the closed position whenever the tank internal pressure is within the tank's internal pressure operating range.

1.6 How Are Normal Venting Requirements for a Tank Using Level 1 Controls Implemented?

The Subpart CC standards allow pressure relief devices to open and vent a fixed-roof tank to the atmosphere during normal operations when the tank internal pressure exceeds the internal pressure operating range determined by the owner or operator. Definitive set point limits were intentionally not specified in the rule. Consequently, this provision of the Subpart CC standards must be implemented on a tank-by-tank basis.

The following sections in this document present additional information that can be used by tank owners and operators and by air pollution regulatory agency personnel for implementing the normal venting provision to a TSDF or 90-day tank using Tank Level 1 controls. Section 2 presents background information about the use of pressure-vacuum relief valves for venting of fixed-roof tanks. Section 3 presents a suggested approach for implementation of the normal venting requirements of §264.1084(c)(3)(ii) and §265.1085(c)(3)(ii).

Section 2.0 Use of PV-Relief Valves for Fixed-Roof Tank Venting

Tanks are used at TSDF for accumulation, storage, and treatment of hazardous waste. Many hazardous waste generators use tanks to accumulate and temporarily store hazardous waste prior to the waste being shipped to a TSDF for treatment and disposal. For managing organic-containing hazardous waste liquids other than wastewaters, the type of fixed-roof tank design commonly used is an aboveground, vertical cylindrical steel-wall tank. However, other tank designs may be used at a given TSDF or waste generator site depending on factors such as the characteristics of the hazardous waste managed in the tank and the type of operations performed at the site. These tanks may be constructed of materials other than steel (e.g., glass-fiber-reinforced plastic (FRP), aluminum alloy, reinforced concrete), may be spherical or horizontal cylindrical shaped, and may be partially buried in the ground or, even in some applications, located underground.

2.1 Fixed-Roof Tank Design

A covered tank is designed to operate at a specific internal pressure. Tanks can be designed to operate at essentially atmospheric pressure or at internal pressures above atmospheric pressure. To build a tank that can safely handle elevated internal pressures requires a more complex structural design (e.g., increased roof and shell plate thickness, different structural shapes) than is used for an equivalent capacity fixed-roof tank designed to operate at atmospheric pressure.

Industry Standards and Codes. Standards and codes for atmospheric and low-pressure fixed-roof tanks used for specific applications have been issued by various professional and trade organizations. The use of these codes and standards refer to Federal and State regulations with regard to tanks storing flammable and combustible organic liquids. None of these codes and standards were developed specifically for TSDF or 90-day tanks managing hazardous waste containing volatile organics. However, the fixed-roof tanks used for this function at a given TSDF or waste generator site are often designed to meet one of these sets of standards as dictated by good engineering practice, insurance requirements, and other site-specific factors

Table 2-1 presents a summary of commonly used codes and standards for storage tanks storing flammable and combustible liquids. The American Petroleum Institute (API) has developed detailed standards for fixed-roof tanks used for storage of liquid petroleum or petroleum products. The API standards address tank design, materials, fabrication, erection, inspection, and testing requirements for welded steel wall atmospheric and low-pressure tanks. These standards include general guidance for use of PV relief valves for normal and emergency venting of tanks. Low-pressure tanks are defined by API to be tanks operating at pressures from 0.5 to 15 pounds per square inch gage (psig). The Underwriters Laboratories, Inc. (UL) has developed standards for steel and FRG tanks used for flammable and combustible liquids. The American Society of Mechanical Engineers (ASME) has developed standards for pressure vessels and aluminum alloy storage tanks.

The National Fire Protection Association (NFPA) also has adopted requirements for the safe storage and use of flammable and combustible liquids in tanks and containers under NFPA 30, *Flammable and Combustible Liquids Code*. The code specifically states it is applicable to “waste liquids” that meet the code's definition of flammable and combustible liquids (NFPA 30 section 1-1.1).

Federal and State Safety Regulations. Tanks subject to the Subpart CC standards may also be subject to other federal and state safety regulations. The U.S. Occupational Safety and Health Agency (OSHA) has established Federal safety standards under 29 CFR Subpart H for tanks storing flammable and combustible liquids (see 29 CFR 1910.106). The NFPA 30, *Flammable and Combustible Liquids Code* is used as the basis for many state and municipal fire and safety regulations. The code has been adopted by authorities in at least 35 States. The federal OSHA regulations and state regulations adopting the NFPA code have many similar requirements and both sets of rules incorporate by reference the use of the appropriate API, ASME, and UL standards described above when applicable to a given tank.

2.2 Venting of a Fixed-Roof Tank

The capability to vent a fixed-roof tank that stores or treats materials containing volatile organic compounds, whether located at a TSDF , waste generator site, or another

Table 2-1. Summary of Selected Standards and Codes That May Be Applicable to Tanks Storing Flammable and Combustible Organic Liquid Wastes

Organization	Citation	Title	Description
American Petroleum Institute	API Standard 620	"Design and Construction of Large, Welded, Low-Pressure Storage Tanks," 9th Edition, February 1996.	This standard addresses the design and construction of large, welded, low-pressure carbon steel aboveground storage tanks (including flat-bottom tanks) that have a single vertical axis of revolution. The tanks described are designed for metal temperatures not greater than 250 °F and with pressures in their gas or vapor spaces not more than 15 psig.
	API Standard 650	"Welded Steel Tanks for Oil Storage," 10th Edition, October 1998.	This standard addresses material, design, fabrication, erection, and testing requirements for aboveground, vertical, cylindrical, closed- and open-top, welded steel storage tanks in various sizes and capacities. Applies to tanks with internal pressures approximating atmospheric pressure, but higher pressure is permitted when additional requirements are met. This standard applies only to tanks whose entire bottoms are uniformly supported and in nonrefrigerated service with a maximum operating temperature of 90 °C (200 °F).
	API Standard 2000	"Venting Atmospheric and Low-Pressure Storage Tanks: Nonrefrigerated and Refrigerated," 5th Edition, April 1998	This standard specifically addresses the normal and emergency vapor venting requirements for tanks. It applies to aboveground liquid petroleum or petroleum products storage tanks, and aboveground and underground refrigerated storage tanks designed for operating at pressures from vacuum through 15 pounds per square inch gauge (1.034 bar gauge).
American Society of Mechanical Engineers	ASME Boiler and Pressure Vessel Code	"Code for Unfired Pressure Vessels", Section VIII, Division 1	This standard addresses the design, materials, fabrication, erection, inspection, and testing requirements for pressure vessels including those used as low-pressure tanks.
	ASME Standard B96.1	"Welded Aluminum Alloy Storage Tanks" 1993	This standard addresses the design, materials, fabrication, erection, inspection, and testing requirements for welded aluminum alloy, field erected or shop fabricated, above ground, vertical, cylindrical, flat bottom, open or closed top tanks storing liquids under pressures approximating atmospheric pressure at ambient temperatures.

Table 2-1 (Continued)

Organization	Citation	Title	Description
National Fire Protection Association	NFPA 30	Flammable & Combustible Liquids Code, 1996 Edition	This code is recommended by NFPA for use as the basis for legal regulations addressing the safe storage and use of flammable and combustible liquids in tanks and containers. The codes include specific requirements for the design, construction, installation, testing, and maintenance of outdoor aboveground tanks, tanks inside buildings, and underground tanks. The code incorporates by reference the use of the appropriate API, ASME, and UL standards described above when applicable to a given tank.
Underwriters Laboratories	UL 58	"Steel Underground Tanks for Flammable and Combustible Liquids," 8th Edition, April 1986	This standard addresses the design and construction of underground steel wall tanks used to store flammable and combustible liquids.
	UL 142	"Steel Aboveground Tanks for Flammable and Combustible Liquids," 7th Edition, April 1986	This standard addresses the design and construction of steel wall tanks with capacities up to 50,000 gallons and used to store flammable and combustible liquids
	UL1316	"Glass-Fiber-Reinforced-Plastic Underground Tanks for Flammable and Combustible Liquids," 2th Edition Revised, April 1996.	This standard addresses the design and construction of spherical or horizontal cylindrical atmospheric type tanks of FRP intended for the underground storage of petroleum based flammable and combustible liquids, alcohols, and alcohol-blended fuels.
	UL 2085	"Protected Aboveground Tanks for Flammable and Combustible Liquids," 7th Edition, April 1986	This standard addresses the design and construction of shop fabricated, aboveground atmospheric protected tanks intended for storage of stable flammable, or combustible liquids that have a specific gravity not greater tan 1.0 and that are compatible with the material and construction of the tank.

type of facility, is necessary to prevent the tank's internal pressure from exceeding its design pressure limits and subsequently causing physical damage or permanent deformation to the tank structure. The internal pressure of a fixed-roof tank storing liquids containing volatile organic compounds can change due to any one of the following conditions:

- Expansion (or contraction) of the organic vapors in the tank vapor headspace because of heating (or cooling) resulting from changes in the ambient temperature.
- Expansion (or contraction) of the organic vapors in the tank vapor headspace because of changes in ambient pressure.
- Increased organic vapor volatization and reduced vapor head space volume inside the tank because of the rising liquid level in the tank resulting from addition of liquid into the tank.
- Increased vapor head space volume inside the tank because of the falling liquid level in the tank resulting from withdrawal of liquid from the tank.
- Rapid expansion of the organic vapors in the tank vapor headspace because of external heating resulting from fire exposure or other unexpected external event.

2.3 Pressure/Vacuum Relief Valves

A pressure-vacuum (PV) relief valve is a device that opens automatically at a pre-set pressure allowing vapors to flow out of the tank or ambient air to flow into the tank depending on the internal pressure of the tank. When the internal pressure of the tank adjusts to a prescribed pressure setting, the valve automatically closes and vapors are no longer vented from the tank (or air no longer flows into tank in cases when vacuum relief is required).

Pressure-vacuum relief valves used for tanks are categorized as *direct-acting* or *pilot-operated*. Table 2-2 presents summary descriptions of the basic types of PV relief valves likely to be used for normal venting of tanks subject to the Subpart CC standards. All three types of PV relief valves listed in Table 2-2 have a machined seat closed by a moveable sealing disk; called a *seat assembly or pallet assembly*. The valve types vary in the mechanism used to hold the seat assembly in the closed position. The closing force applied to the seat assembly determines the set point of the valve. The pressure in the vapor space of the tank pushes against the seat assembly, opposing the closing force. When the tank pressure reaches the set point, the seat assembly begins to lift from the

Table 2-2. Summary of Pressure-Vacuum Relief Valves

Category	Operating Mechanism	Description
Direct-acting	Weighted-loaded	The downward force on the valve seat exerted by the weight of the seat assembly keeps the valve closed. Increasing internal tank pressure acting upward on the seat sealing area eventually overcomes the weight and causes the pallet to lift and the valve to open. The valve set point is changed by adding or removing weight plates mounted on top of the seat assembly or installing a new assembly.
	Spring-loaded	The downward force on the valve seat exerted by a spring on top of the seat assembly keeps the valve closed. Increasing internal tank pressure acting upward on the seat sealing area eventually overcomes the downward spring force and causes the pallet to lift and the valve to open. The valve set point is changed by adjusting the spring tension or replacing the spring with another spring having the desired force rating. Spring-loaded relief valves are available in several design variations.
Pilot-operated	Pressure differential	The downward force on the valve seat exerted by tank pressure acting on a diaphragm in a dome over the seat assembly keeps the valve closed. A small pilot control valve continuously senses the tank pressure. When the tank pressure increases to the set point value, the pilot valve actuates to reduce the pressure in the dome, reducing the pressure over the pallet, and allowing the valve to open. Pilot-operated relief valves are available in several design variations.

valve seat and vapors in the tank vapor headspace are allowed to escape (or air can enter) through the PV relief valve until the tank's internal pressure readjusts to level within the tank's design range.

Direct-acting PV relief valves use either the weights on top of the seat assembly or the force of a spring against the seat assembly to maintain valve seat closure. These are the type of PV relief valve usually being referred to when term "conservation vent" is used. Valve manufacturers offer different models and sizes of a PV relief valves, each of which can be set to a range of pressure set point values in a series of stepped increments between minimum and maximum values. For a typical tank installation, the specific pressure and vacuum set points required for a given tank are set at the factory by the valve manufacturer. The designs of direct-acting PV valves make changes from the factory set point levels difficult once a valve has been installed on the tank.

A pilot-operated PV relief valves does not use a mechanical force (i.e., weights or a spring) to maintain closure of the seat assembly. Instead, a downward force on the seat assembly is maintained by pressurizing the air or gasses inside a dome over the seat assembly. A second small, positively actuated valve (the "pilot" valve) is use to monitor the internal pressure in the tank and to control the opening and closing of the large main valve by regulating the pressure in the dome. At the set point pressure, the pilot valve opens reducing the pressure inside the dome which allows the seat assembly to rise and the main valve to open. The pilot valve closes at a preset pressure allowing the dome to repressurize to full inlet pressure closing the main valve.

Installing a direct-acting PV relief valves on a tank is less expensive that using a pilot-operated PV relief valve. However, using a pilot-operated PV relief valve offers two principal operating advantages over direct-acting PV relief valves. First, the seat assembly in a pilot-operated PV valve remains tightly closed until the set point pressure is the reached, and second, the valve is fully open at less than 10 percent above set point pressure allowing a rapid pressure adjustment. These characteristics allow the internal operating pressure of the tank to be maintained at levels very close to the maximum allowable working pressure for the tank.

2.4 Application of PV Relief Valves to Fixed-Roof Tanks

For application to fixed-roof tanks, PV relief valves typically are mounted to a flange or pipe that connects to the vapor space within the tank that is above the liquid surface.

The PV relief valves are frequently mounted on large tanks near the outer edge of the roof and next to stairways or platforms to allow access for inspection and maintenance of the valve. When choosing the PV relief valves for a given fixed-roof tank key information used by the tank designer includes the following.

Tank Total Rate of Venting. Total rate of venting is the total volumetric rate at which the vapor or gas mixture in the tank vapor headspace must be released from the tank to prevent the internal tank pressure from attaining a level that exceeds the maximum pressure that the tank is structurally designed to withstand. This parameter is sometimes called the venting capacity. The total rate of venting is usually stated in units of standard cubic feet of air per hour (SCFH). Separate normal venting and emergency venting rates are calculated on a case-by-case basis for a given tank. Equations and tables of guideline values for calculating the total rate of venting for specific normal venting and emergency venting situations are available in many of the standards listed in Table 2.1. Commonly cited equations and tables are those presented in API Standard 2000, the OSHA standards under 29 CFR 1910.106, and the NFPA Code 30.

Tank Maximum Design Pressure. A tank is a self-supporting structure fabricated by assembling individual structural components. There are limits as to the level of internal pressure and vacuum that a tank can withstand before the tank's structural components are physically deformed or damaged (e.g., a steel plate buckles, a welded or bolted seam fails). The tank maximum design pressure is the highest internal pressure the tank can sustain before the tank's structural integrity is affected.

Tank Maximum Allowable Working Pressure. The maximum allowable working pressure is a term used in the API tank standards and the ASME Pressure Vessel Code. As used in the API standards, the term refers to the internal pressure at the top of the tank vapor head space when the tank is filled to the maximum liquid level.

Tank Minimum Operating Pressure. For some tank applications, a specific elevated pressure or vacuum must be maintained in the tank. This specifies a minimum operating pressure for the tank such that during normal operations the tank pressure relief devices will not open and begin relieving below the pressure required by tank operating conditions.

Type and Size of PV Relief Valves. Pressure/vacuum relief valves are available in a range of types and sizes from a number of manufacturers. Larger size vents provide greater flow capability than smaller size vents. Each size and type of PV relief valve will provide a specific volumetric flow of vapors at a given set point pressure. For a given tank, a PV relief valve size or a combination of valves is selected to provide the total venting capacity needed to meet the computed normal venting requirement. These PV relief valves can be directly open to the atmosphere or connected to a control device. Additional pressure relief devices are then specified for the tank to provide the increased venting capacity necessary to meet the computed emergency venting requirement. These devices remain closed during normal venting and will open only in an emergency. The emergency pressure relief may be additional PV relief valves but can also be other types of devices such as hatches or manhole covers that automatically lift under abnormal internal tank pressure conditions. In cases when a PV relief valve is to provide emergency venting capacity, the valve opens at a higher pressure than the PV relief valves used on the tank for normal venting.

2.5 Selection of PV Relief Valve Set Points

The set point for a PV relief valve is the pressure (or the vacuum) at which the valve begins to open. For a PV relief valve to serve its intended function (i.e., protect the structural integrity of the tank), the pressure set point for a PV relief valve obviously must be at a value less than the tank's maximum design pressure. Therefore, the question becomes at what pressure below the tank's maximum design pressure should be used for the PV relief valve set point. The standards and codes issued for fixed-roof tanks do not provide universal formulas by which the set point pressure can be calculated . Too many site-specific variables affect which pressure should be used for the PV relief valve set point to provide a reasonable margin of safety for all possible tank conditions. Thus, the PV relief valve set point is determined on a tank-by-tank basis considering the site-specific safety and regulatory requirements applicable to a given tank.

In practice, the selection of the pressure set point value for a PV relief valve often is based on the maximum allowable working pressure for which the tank is designed. Some of the standards and codes provide general guidance for selecting the set points for tank pressure relief devices. API Standard 620 provides specific pressure setting guidance for low pressure tanks. The standard recommends that the set point value on pressure relief devices used to provide normal venting capacity be set to prevent the internal pressure from increasing more than 10 percent above the maximum allowable working pressure. For additional relief devices used only to provide emergency venting capacity, the recommended setting is a value to prevent the internal pressure from increasing more than 20 percent above the maximum allowable working pressure. It is important to recognize that these guidelines are not absolute and applicable to all tanks. For specific tank applications, the set point for the PV relief valve may need to be lower than the maximum allowable working pressure to allow for adequate flow capacity of the valves selected to be installed on the tank.

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Section 3.0 Implementation of Tank Level 1 Control Normal Venting Requirements

The EPA established the Subpart CC standards to control the emission of volatile organics to the atmosphere from tanks, surface impoundments, and containers used to manage RCRA hazardous wastes. These waste materials are flammable, combustible, explosive, reactive, or have other hazardous properties. Consequently, the use of any air emission controls at these facilities must be implemented following all safety regulations and good engineering practices as appropriate for a given type of hazardous waste.

In recognition of the safety requirements for tanks, the EPA included provisions in the Subpart CC standards that allow the venting of a fixed-roof tank as required to protect the tank's structural integrity during normal operations. Under §264.1084(c)(3)(ii) and §265.1085(c)(3)(ii) of the Subpart CC standards, a given fixed-roof tank using Tank Level 1 controls may be vented directly to the atmosphere during normal operations when the tank's internal pressure exceeds the internal pressure operating range determined by the owner or operator of the tank. This section discusses the implementation of the provisions in §264.1084(c)(3)(ii) and §265.1085(c)(3)(ii).

Before proceeding to determining compliance of a given tank with §264.1084(c)(3)(ii) or §265.1085(c)(3)(ii) (as applicable to the tank), the first step is to check that the tank qualifies to use Tank Level 1 controls. If the tank does not qualify to use Tank Level 1 controls, then the provisions of §264.1084(c)(3)(ii) or §265.1085(c)(3)(ii) do not apply to the tank. Assuming the tank meets all three of the conditions for Tank Level 1 controls specified in the Subpart CC standards, then addressing the compliance of the tank with the venting provisions specified in the rule is appropriate.

3.1 Why Are Continuously Open Vents Not Allowed on a Tank Using Level 1 Controls?

Organic air emissions from fixed-roof tanks with continuously open vents occur during normal tank operations primarily by two emission mechanisms; *working losses* and to a lesser extent, *breathing losses*. When wastes containing volatile organics are managed in a fixed-roof tank, a portion of the organics in the waste will volatilize and these vapors collect in the internal volume between the surface of the liquid or other waste material in the tank and the tank roof (the tank "head space"). Working losses result when additional waste is pumped into the tank and the vapors in the tank head space are pushed out of the tank through the open vents by the rising waste level. Breathing losses occur when the volume of vapor in the tank headspace is increased from changes in ambient temperatures or pressure and the vapors flow through the open vents. The level of organic emissions from a given tank varies with the concentrations and volatility of the individual organic constituents composing the waste material managed in the tank.

For effective organic air emission control of fixed-roof tanks, preventing the tank vents from being continuously open to the atmosphere is essential. Thus, the Tank Level 1 Control standards under Subpart CC require the use of a spring-loaded pressure-vacuum relief valve, conservation vent, or similar type of pressure relief device. As discussed in Section 2, a PV relief valve opens to release the organic vapors from the tank into the atmosphere only at those times when the tank internal pressure is greater than the valve pressure set point. When the tank internal pressure is reduced below the valve pressure set point, the valve closes and organic vapors are no longer vented from the tank. As a result, organic vapors are not continuously emitted from the tank and air emissions occur only during those situations when tank operating conditions require the vents to be open. The presence of properly set conservation vent can reduce tank breathing and working losses by as much as 20 to 45 percent depending on the design of the fixed roof tank. In situations when a vacuum is formed within the tank and the negative internal pressure of the tank exceeds the vacuum set point, the PV relief valve opens to admit air into the tank until the vacuum is reduced below the valve set point. Since outside air flows into the tank there are no air emissions in this situation.

3.2 Must a Tank Using Level 1 Controls Be Vented Through PV Relief Valves to Comply With the Rule?

No. Sections 264.1084(c)(3)(ii) and 265.1085(c)(3)(ii) are applicable to only those situations where the tank owner or operators chooses to vent the tank directly to the atmosphere. The provisions do not mandate that a tank using Level 1 controls be vented directly to the atmosphere. Because of safety, fire protection, economic, or other site-specific considerations, an owner or operator may elect to vent a tank using Level 1 controls to a "closed" system that releases minimal, if any, of the volatile organic vapors from the tank to the atmosphere. Examples of such systems include using a vapor balancing system, a gas blanketing system, or a vapor recovery system. For a tank using Level 1 controls but not vented directly to the atmosphere, the provisions of §264.1084(c)(3)(ii) or §265.1085(c)(3)(ii) do not apply to the tank.

3.3 When Is a PV Relief Valve on a Tank Considered To Be a Safety Device under the Rule?

Fixed-roof tanks are also equipped with safety devices in addition to a pressure-vacuum relief valve used to adjust the internal pressure of the tank during normal operations. These safety devices provide additional venting capacity to relieve excessive internal pressure from unusual conditions resulting from non-routine events such as a fire or a malfunction of the regular PV relief valve. Often a second PV relief valve is used to provide the emergency venting capacity but it can also be another type of device that opens only in an emergency (e.g., a rupture disk or a hatch that lifts under abnormal pressure conditions). The pressure setting for the emergency vent is higher than the full capacity pressure setting of the PV relief vent used to adjust the internal pressure of the tank during normal operations.

Pressure relief devices which are being used as "safety devices" must meet the following conditions:

1. The device is not used for planned or routine venting and
2. The device must remain in the closed, sealed position at all times during normal operation. These devices are normally rupture disks, "O-rings", a discharge port to a closed-vent system, or other one-time emergency-use devices. 40 CFR Parts 264.154 and 265.1054, Subpart BB equipment standards for pressure relief

devices in gas/vapor service were intended for the maintenance and monitoring of this group of pressure relief devices in "safety device" service.

The provisions for venting during normal operations in paragraph (c)(3)(ii) of §264.1084 or §265.1085 do not apply to a given PV relief valve for which the sole function is to be an emergency vent for the tank. This means the device opens only in those situations when an unplanned or accidental event occurs (e.g., a fire or the malfunction of the regular PV relief vent). The device remains closed in response to pressure changes caused by filling operations or diurnal ambient temperature fluctuations. A PV relief valve meeting these general criteria is considered a "*safety device*" as defined under the Subpart CC standards and is subject to the requirements in paragraph (c)(3)(iii) of §264.1084 or §265.1085.

3.4 Can PV Relief Valve Designs Other Than Spring-Loaded be Used to Comply With the Rule?

Yes. Although the rule language specifically mentions a "spring-loaded pressure-vacuum relief valve", weight-loaded and pilot-operated PV relief valves also can be used to comply with the provisions of §264.1084(c)(3)(ii) or §265.1085(c)(3)(ii). The EPA recognizes that other PV relief valve designs commercially available provide comparable performance to the spring-loaded designs, and the Agency never intended to restrict the requirement to only spring-loaded PV relief valves. As discussed in Section 2, the basic operation of weight-loaded and pilot-operated PV relief valves is the same as spring-loaded PV relief valves. The primary differences between the different types of PV relief valves are the mechanisms used to maintain closure of the valve seat assembly.

3.5 Why Are Set Point Limit Values for PV Relief Valves Not Specified in the Rule?

The set point for a pressure-relief device is the pressure (or vacuum) at which the device begins to open. Specific set point values are not specified in the Subpart CC standards for PV relief valves used on TSDF and 90-day tanks for three major reasons: 1) the diversity of tank types and designs used at facilities handling hazardous wastes that are subject to the Subpart CC standards; 2) the variability and unpredictability of the hazardous waste characteristics managed in hazardous waste storage tanks; and 3) the need to avoid establishing a specific set point value that may conflict with Federal, State, or local safety regulations applicable to a given TSDF or waste generator site for tanks storing flammable and combustible liquids.

A tank is broadly defined under RCRA to be “a stationary device designed to contain an accumulation of hazardous waste constructed primarily of nonearthen materials (e.g., wood, concrete, steel, plastic) which provide structural support.” Under this definition, the Subpart CC standards are applicable to a large, diverse group of tank sources. The tanks may be located at facility that receives hazardous wastes from many different waste generators. Tanks potentially subject to the Subpart CC standards include those not only used for storage of organic liquids but also tanks used for storage and treatment of hazardous wastewaters, oil-water waste mixtures, sludges, and other semi-solid wastes.

The many types and variations in tank designs used for managing hazardous waste prevents one from selecting a single universally applicable set point value applicable to all tanks potentially subject to the Subpart CC standards. Establishing specific set point values under Subpart CC would need to consider and address the structural integrity of not only an aboveground, vertical cylindrical steel-wall tank but also tanks constructed of materials other than steel (e.g., glass-fiber-reinforced plastic (FRP) or reinforced concrete), tanks that are spherical, horizontal cylindrical, or rectangular shaped, and tanks that are partially or totally buried underground. Even for a particular type of tank such as aboveground, vertical cylindrical steel-wall tanks, different set point values would need to be set based on specific design characteristics (e.g., whether the tank is designed to operate at atmospheric or elevated pressure, whether the tank is fabricated using welded or bolted steel plates). Thus, a single set point value cannot be established that is applicable to all tanks subject to the Subpart CC standards. Instead, set point values would need to be established for many tank groupings or categories defined by specific design characteristics.

The large variability and unpredictability in the characteristics of the hazardous wastes managed in the tanks potentially subject to the Subpart CC standards makes establishing individual set point values for pressure relief devices used for a given tank grouping a very difficult task. The set point for a pressure relief device is determined based on the tank's maximum allowable working pressure or internal design pressure. For a tank managing hazardous waste containing volatile organic compounds, the internal tank pressure varies with the compositions and concentrations of the individual organic compounds in the waste. Unlike tanks used to store organic liquids with consistent characteristics (e.g., gasoline), the characteristics of hazardous waste managed at TSDF and waste generator sites are variable and unpredictable because of the nature of day-to-day operations at these facilities. The types and characteristics of hazardous wastes managed vary from facility to facility depending on the sources generating the wastes. At many TSDF (especially commercial TSDF), hazardous wastes are received from many different hazardous waste generators. On a given day, a TSDF can receive wastes from one group of generators and the next day the facility can receive new wastes from a completely different group of generators. Because of this operating mode, the compositions and concentrations of individual organic compounds in the waste managed in a given tank can constantly be changing over short periods (i.e., daily, weekly, monthly). Thus, it is not possible to predict with a reasonable level of confidence the organic characteristics of the waste that will be managed in a given TSDF or 90-day tank in the future. Without having a consistent set of characteristics for the hazardous waste managed in a given tank category, it is difficult to determine a general set point for the tank category that will provide meaningful air emission control during normal venting and still provide the appropriate margin of safety for all TSDF and 90-day tank situations that possibly could be subject to requirements established for the category.

Finally, the EPA does not want to create an unsafe situation for a given TSDF or 90-day tank where a minimum allowable set point value established under the Subpart CC standards is higher than a maximum allowable set point value determined by good engineering practices or to comply with a safety regulation also applicable to the same tank. For example, while not all hazardous waste having an average volatile organic concentration at or above 500 ppmw (e.g., hazardous wastewaters and sludges) meet the definition of flammable and combustible liquids, many TSDF or 90-day tanks are used to manage hazardous organic liquids that are flammable and combustible (e.g., spent or contaminated organic solvents, off-specification organic products). Federal regulations issued by the U.S. Occupational Safety and Health Agency (OSHA) establish standards in 29 CFR Subpart H for the tanks storing flammable and combustible liquids. The National Fire Protection Association (NFPA) has developed requirements for tanks storing flammable and combustible liquids that have been incorporated into many State and municipal fire codes. Both of these sets of regulations specify requirements for normal and emergency venting of tanks.

The intent of the Subpart CC standards is to practically and safely reduce organic air emissions from fixed-roof tanks by requiring the use of pressure relief devices that open only when necessary to prevent physical damage or permanent deformation to the tank.

Universally applicable set point values at which pressure-relief devices must open to ensure a given tank operate safely cannot be determined for TSDF and 90-day tanks potentially subject to the Subpart CC standards. Thus, an approach is adopted by which the set point value for pressure relief devices installed on a given tank using Tank Level 1 controls under the Subpart CC standards is determined by the tank's owner or operator on a case-by-case basis considering the site-specific safety and regulatory requirements applicable to the tank as well as the tank's design and operating conditions.

3.6 How Are §264.1084(c)(3)(ii) and §265.1085(c)(3)(ii) Implemented?

The necessity of using an approach by which specific set point values for the PV relief valves are not specified in the rule adds a element of judgement to implementing the provisions under §264.1084(c)(3)(ii) and §265.1085(c)(3)(ii). Implementing these provisions for a given TSDF or 90-day tank requires using site-specific information and assessing whether or not the pressure relief device used on the tank for normal venting meets the regulatory intent of the provision (i.e., reduce, to the extent practical and safe, organic air emissions from the tank during normal operations).

The requirements of §264.1084(c)(3)(ii) and §265.1085(c)(3)(ii) require the set point for the pressure relief device be established such that the device remains in the closed position whenever the tank internal pressure is within the internal pressure operating range determined by the owner or operator based on the safe handling of flammable, combustible, explosive, reactive, or hazardous materials. Considering the regulatory intent of the provision, it is reasonable to expect that the set point for a pressure relief device not be set at a level so low that the device remains open continuously or most of the time. If this situation were allowed under the Tank Level 1 control requirements, then effective control of the organic air emissions from the tank would not be achieved.

The regulatory intent of controlling organic emissions from the tank is balanced with the need to do so in a safe manner. The safe operation of a tank storing or treating waste containing volatile organics depends on a combination of site-specific factors (e.g., the tank design, the types and concentrations of organics in the waste). Therefore, the upper limit to any set point value must defer to the level at which it is safe to operate the tank based on all applicable safety standards, codes, and practices. A tank for which the set point value is in the range of the maximum allowable working pressure for the tank meets the regulatory intent of the provision because the device remains closed except when venting of the tank's internal pressure is near or exceeds the upper end of the tank's intended operating range (i.e., the internal pressure at the top of the tank vapor head space when the tank is filled to the maximum liquid level). However, a set point at a value below the maximum allowable working pressure may be required considering tank-specific factors.

3.7 How Can Compliance With §264.1084(c)(3)(ii) and §265.1085(c)(3)(ii) Be Determined?

A compliance determination approach is presented below. This approach is based on the premise of answering a series of questions to determine if a good faith effort has been made to meet the requirements of §264.1084(c)(3)(ii) or §265.1085(c)(3)(ii). It is a general approach that is applicable to many common tank operations expected to be subject to the Subpart CC standards. However, it is not an all encompassing approach applicable to every tank potentially subject to the Subpart CC standards. Special tank designs, hazardous waste characteristics, or other unique site factors may require that this approach not be used, and a separate site-specific determination be made based on the site-specific circumstances.

Using this approach, compliance with the provisions of §264.1084(c)(3)(ii) and §265.1085(c)(3)(ii) is determined based on the positive pressure set point for the PV relief value. While important for safe operation of the tank , the negative pressure or vacuum set point of the PV relief valve does not result in the direct release of vapors to the atmosphere since outside air flows into the tank. Therefore, from the perspective of determining compliance with the regulatory intent of the provisions, an evaluation of the vacuum set point is not needed.

Application of the following series of questions to assess compliance with the provisions of §264.1084(c)(3)(ii) or §265.1085(c)(3)(ii) (as applicable to a given tank) is predicated by the conditions that: a) you have already checked to verify that the tank meets all of the conditions to qualify to use Tank Level 1 controls listed in §264.1084(b)(1) or §265.1085(b)(1); and b) you have checked to verify the fixed roof for the tank meets the other equipment requirements listed in §264.1084(c)(2) or §265.1085(c)(2).

QUESTION 1. Are all vents on the tank equipped with or connected to devices that are not continuously open to the atmosphere?

Yes	Go to Question 2
No	Tank does not comply with §264.1084(c)(3) or §265.1085(c)(3). The tank fails the requirement that each opening on the fixed-roof must be either equipped with a closure device or connected by a closed-vent system to a control device. **STOP**

QUESTION 2. Does each vent pipe (or stack) used for normal venting of the tank connect to one of the following:

(a) vapor recovery system,
(b) vapor balance system,
(c) gas-blanketing system, or
(d) other closed system that does not vent directly to the atmosphere.

Yes	The requirements of §264.1084(c)(3) or §265.1085(c)(3) do not apply to the tank because the tank does not vent directly to the atmosphere during normal operations. **STOP.**
No	Go to Question 3

QUESTION 3. Is each vent pipe (or stack) used for normal venting of the tank but not connected to one of the closed systems listed in Question 2 equipped with a direct-acting or pilot-operated PV relief valve (or “conservation vent”)?

Yes	Go to Question 4
No	Request from the tank’s owner or operator documentation with a detailed description of the device used for normal venting of the tank. Using the provided information, make a case-specific judgement as to whether the device meets the requirements that it operate with no detectable organic emissions when the device is secured in the closed position and that the device remains in the closed position whenever the tank internal pressure is within the tank’s internal pressure operating range. If your finding is the documentation adequately shows the device meets these requirements, then tank complies with §264.1084(c)(3) or §265.1085(c)(3). If your finding is the documentation is inadequate or fails to show the device meets these requirements, then tank does not comply with §264.1084(c)(3) or §265.1085(c)(3). **STOP.**

QUESTION 4. Is the set point value for each PV relief valve used for normal venting of the tank equal to or greater than the maximum allowable working pressure for the tank?

Answering this question requires obtaining the values for maximum allowable working pressure for the tank and the set points for each PV relief valve used for normal venting. If this information is not readily available from the tank owner or operator, skip directly to Question 5.

Yes	Tank complies with §264.1084(c)(3) or §265.1085(c)(3). **STOP.**
No	Go to Question 5
Do not know	Go to Question 5

QUESTION 5. This is two-part question. Start with Question 5a.

– **Question 5a.** Is the tank subject to Federal, State, or municipal regulations and codes that apply to storage of flammable and combustible liquids in tanks (e.g., U.S. Occupational Safety and Health Agency (OSHA) standards under 29 CFR 1910.106, State or municipal fire prevention and protection codes adopting NFPA 30, *Flammable and Combustible Liquids Code*)?

Yes	Go to Question 5b
No	Go directly go to Question 6.

– **Question 5b.** Does the safety or fire protection regulation or code applicable to the tank require the installation and use of PV relief valves on the tank for normal venting, and are the valve settings compliant with the code or regulation?

Yes	Tank complies with §264.1084(c)(3) or §265.1085(c)(3). The rule language in § 264.1084(c)(3)(ii) and § 265.1085(c)(3)(ii) indicates that a tank PV valve setting based on “applicable regulations, fire protection and prevention codes, standard engineering codes and practices, or other requirements for the safe handling of flammable, combustible, explosive, reactive, or hazardous materials” is compliant with the intent and plain reading of the Subpart CC rule requirements. **STOP**.
No	Go to Question 6

QUESTION 6. Does the tank meet all requirements under a specific American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), Underwriters Laboratory (UL), or National Fire Protection Association (NFPA) standard or code requiring the installation and use of PV relief valves on the tank for normal venting?

Yes	Tank complies with §264.1084(c)(3) or §265.1085(c)(3). The safety or fire protection regulation or code need not be "applicable" to the tank and its PV relief valves. The language in § 264.1084(c)(3)(ii) and § 265.1085(c)(3)(ii) allows that a valve setting based on relevant and appropriate fire and safety codes is adequate for compliance with the intent of this provisions of the Subpart CC RCRA Air Rules. **STOP.**
No	Go to Question 7.

QUESTION 7. Can the tank's owner or operation provide a copy of the documentation describing the tank or PV relief valve manufacturer recommendations; standard engineering codes and practices; or other requirements for the safe handling of flammable, combustible, explosive, reactive, or hazardous materials used by the tank owner or operator to select the pressure set point for each PV relief valve used for normal venting?

Yes	Request from the tank's owner or operation a copy of the documentation describing how he or she selected the set point used for each valve. Using the provided documentation, make a case-specific judgement as to whether the documentation specifically addresses the use of PV relief valves on the tank for normal venting and explains the basis for the selected set point value. If your finding is the documentation adequately addresses the use of PV relief valves, then tank complies with §264.1084(c)(3) or §265.1085(c)(3). If your finding is the documentation is inadequate, then tank does not comply with §264.1084(c)(3) or §265.1085(c)(3).
No	The tank does not comply with §264.1084(c)(3) or §265.1085(c)(3). The tank fails to meet the requirement that the pressure set point shall be established such that the device remains in the closed position whenever the tank internal pressure is within the internal pressure operating range based on the tank manufacturer recommendations, applicable regulations, fire protection and prevention codes, standard engineering codes and practices, or other requirements for the safe handling of flammable, combustible, explosive, reactive, or hazardous materials.