U.S. Environmental Protection Agency Applicability Determination Index

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Title: Subpart Kb Application to Wastewater Detoxification Tanks
Recipient: John Slade
Author: Judith Katz

Subparts: Part 60, Kb, Storage Vessels for VOCs (post 7/23/84)

References: 60.110b
60.111b(f)
60.111b(k)
60.112b
60.116b
63.100-106
63.110-152
63.1250-1261
63.540-655

Abstract:

Q. Is NSPS Subpart Kb applicable to three existing 100,000 gallon wastewater detoxification tanks?

A. No. For reasons other than those submitted by the company, EPA agrees that NSPS Subpart Kb does not apply to the tanks. See the letter below for EPA's discussion of all pertinent and specific information used in this determination. The letter also addresses and discusses why the reasons submitted by the company to try to support this decision were not used.

Letter:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Mr. John F. Slade, Chief
Division of Permits
Pennsylvania Department of Environmental Protection Rachel Carson State Office Bldg.
400 Market 12th Floor Harrisburg, PA 17105

Dear Mr. Slade:

Your letter dated September 19, 2000, requests that the United States Environmental Protection Agency assist the Pennsylvania Department of Environmental Protection (PADEP) in determining the applicability of the New Source Performance Standards (NSPS) Subpart Kb, Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced after July 23, 1984, 40 C.F.R. Secs. 60.110b - 116b, to three (3) existing 100,000 gallon wastewater tanks at Merck & Co.'s (Merck) Cherokee facility in Danville, Pennsylvania. Pursuant to your letter we have reviewed the information that Merck has submitted to EPA either directly or through PADEP regarding this issue. Merck, through a report prepared by its consultant, Versar Inc., entitled "Evaluation of the Applicability of New Source Performance Standards, Subpart Kb for the Avermectin Wastewater Tanks at the Merck Cherokee Facility," (Versar Report) has requested that PADEP consider these three tanks exempt from NSPS Subpart Kb because NSPS Subpart Kb was not intended to apply to wastewater tanks containing dilute VOCs in aqueous solution.

Facts

According to your letter of September 19 and the Versar Report attached to it, the three 100,000 gallon tanks at issue are part of the system that detoxifies wastewater generated by Merck's Avermectin processes (the Avermectin Wastewater Detoxification System, or AWDS). The tanks are located upstream of the on-site wastewater treatment plant (WWTP). The three tanks are similar in design and are top-filled, open-topped (via manway), and equipped with overflow lines.

There are eight other tanks in the AWDS, but, only the three 100,000 gallon tanks designated TA-870, TA-871 and TA-889, are potentially affected by New Source Performance Standard (NSPS) Subpart Kb. The other eight tanks do not meet the applicable criteria for design capacity and/or installation/reconstruction date specified in NSPS Subpart Kb as affected sources.

The composition of the Avermectin wastewater is approximately 99.3 % water (by weight) and less than 1% volatile organic compounds (VOCs). According to a January 16, 2001 e-mail from Janet H. Friday of Merck to Theresa Horgan of EPA, the estimated concentration of VOCs in the Avermectin wastewater is ethanol (0.45%), methanol (0.12%), toluene (0.10%), hexane (0.05%), and others (0.02% of acetonitrile, heptane, isopropyl acetate and n-butyl acetate). The Avermectin detoxification process uses two equalization tanks (TA-870 and TA-871) and four holding/testing tanks (which includes TA- 889). The equalization tanks receive wastewater from a main wastewater collection tank that typically runs around 30 C. The wastewater then passes through more tanks and into two plug-flow reactors in which a hot caustic hydrolysis reaction breaks down the Avermectin. The effluent from the reactor system is approximately 50 C and is discharged to one of the four holding/testing tanks. The wastewater is then tested and after obtaining acceptable test results is discharged to the facility's wastewater treatment plant, and ultimately discharges to the Susquehanna River . See Application for Review Memo, Merck & Company, Riverside Borough, Northumberland County, Plan Approval Application OP-49-0007A, from David W. Aldenderfer, PADEP to John Twardowski, PADEP (8/21/00).

Merck is in the process of implementing a two-phase emission reduction project to reduce emissions from the AWDS to comply with their revised Reasonable Achievable Control Technology (RACT) limits and the Pharmaceutical MACT regulation. The first phase involved modifying the six 100,000 gallon tanks (the two equalization and four holding/testing tanks) by reducing the size of the tank vents, reconfiguring the fill lines for subsurface filling, and sealing the overfill lines to reduce air flow. This phase of the project was completed in late 2000. The second phase of the project is being made to comply with the revised RACT limits for the AWDS as well as the Pharmaceutical MACT (40 C.F.R. Secs. 63.1250 - 1261). The second phase includes enhancements to the Avermectin Toluene and the SGA & Avermectin wastewater stripping systems to reduce the concentration of VOCs in the wastewater sent to the AWDS and the on-site WWTP. Enhancements to the Avermectin Toluene wastewater stripper (CL-759) include two (2) new stills equipped with new process condensers and an associated decanter installed prior to the existing stripper column. In addition, a new condensate collection tank will be installed in order to strip solvent from an additional stream. Enhancements to the SGA & Avermectin watewater stripper (CL-2800) include reactivating an existing tank to serve as a wastewater collection tank and installing a new condensate collection tank in order to allow additional wastewater streams to be stripped in this wastewater stripper. This second phase will be completed by early 2002.

NSPS Subpart Kb Applicability and Requirements

NSPS Subpart Kb applies to any storage vessel with a capacity greater than or equal to 40 cubic meters (m3) that is used to store a "volatile organic liquid" (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984. The three existing wastewater tanks met the applicable date since these tanks were either constructed or reconstructed after July 23, 1984. According to NSPS Subpart Kb, 40 C.F.R. Sec. 60.112b:

The owner or operator of each storage vessel either with a design capacity greater than or equal to 151 m3 containing a VOL that, as stored, has a maximum true vapor pressure equal to or greater than 5.2 kPa but less than 76.6 kPa or with a design capacity greater than or equal to 75 m3 but less than 151 m3 containing a VOL that, as stored, has a maximum true vapor pressure equal to or greater than 27.6 kPa but less than 76.6 kPa, shall equip each storage vessel with one of the following:

(1) A fixed roof in combination with an internal floating roof meeting . . .

(2) An external floating roof . . .

(3) A closed vent system and control device meeting the following specifications . . .

(i) The closed vent system shall be designed to collect all VOC vapors and gases discharged from the storage vessel . . .

(ii) The control device shall be designed and operated to reduce inlet VOC emissions by 95 percent or greater. . .

(4) A system equivalent to those described in . . . this section . . . .

The three 100,000 gallon tanks meet the applicable design capacity of 151 m3. In addition, because the Avermectin wastewater contains ethanol, methanol, toluene, hexane, and other VOCs, the three wastewater tanks contain at least one VOL, which is defined at 40 C.F.R. 60.111b(k) as "any organic liquid which can emit volatile organic compounds into the atmosphere except those VOL's that emit only those compounds which the Administrator has determined do not contribute appreciably to the formation of ozone."

As stated above, the Versar Report which Merck submitted to PADEP requested that these three tanks be considered exempt from NSPS Subpart Kb because NSPS Subpart Kb was not intended to apply to wastewater tanks containing dilute VOCs in aqueous solution.

Subpart Kb generally applies to any storage vessel that has a capacity greater than or equal to 40 cubic meters that is used to store volatile organic liquids (VOLs), and which the construction, reconstruction or modification of which commenced after July 23, 1984. 40 C.F.R. Sec. 60.110b(a). There are a number of enumerated exemptions to some or all of the regulatory requirements of Subpart Kb. The only potentially relevant exemption for the three Merck tanks is that contained in 40 C.F.R. Sec. 60.110b(c), which provides:

Except as specified in paragraphs (a) and (b) of Secs. 60.116b, vessels either with a capacity greater than or equal to 151 m3 storing a liquid with a maximum true vapor pressure less than 3.5 kPa or with a capacity greater than or equal to 75 m3 but less than 151 m3 storing a liquid with a maximum true vapor pressure less than 15.0 kPa are exempt from the General Provisions (Part 60, Subpart A) and from the provisions of this subpart.

Each would be exempt only if the liquid stored within the tanks had a maximum true vapor pressure less than 3.5 kPa.

The preamble to NSPS Subpart Kb makes clear that being below the capacity or vapor pressure cut points are the only ways explicitly provided in the regulation to avoid NSPS Subpart Kb applicability. The Preamble is also clear why NSPS Subpart Kb does not have a blanket exemption for tanks that are part of a wastewater treatment system:

Several commenters requested an exemption to the recordkeeping requirements for tanks used to store a mixture of different products ("slop oil") and for tanks used to retain wastewater after the organic liquids have been removed in an oil-water separator. The commenters said that the constantly changing nature of the products and the associated vapor pressure in the slop oil vessels would necessitate physical testing to determine vapor pressure as required in the proposed standards. The wastewater vessels contain liquids with low vapor pressures such that operational monitoring is inappropriate. The purpose of the vapor pressure determination is to distinguish between the three possible classes of VOL's that are of concern:

1. Those liquids with vapor pressures greater than or equal to a control cutoff (27.6 kPa [4 psia] for vessels with capacities of 75 m3 [20,000 gal] or greater and 5.2 kPa [0.75 psia] for vessels with capacities of 151 m3 [40,000 gal] or greater);

2. Those liquids that are exempt from all vapor pressure recordkeeping provisions of the standards (less than 15 kPa [2.2 psia] for vessels with capacities between 75 and 151 m3 [20,000 and 40,000 gal] and less than 3.5 kPa [0.51 psia] for vessels with capacities of 151 m3 [40,000 gal] or greater); and

3. Those liquids for which monitoring, but not emission control, is required (greater than or equal to 15 kPa [2.2 psia] and less than 27.6 kPa [4 psia] for vessels with capacities ranging from 75 to 151 m3 [20,000 to 40,000 gal] and greater than or equal to 3.5 kPa [0.51 psia] and less than 5.2 kPa [0.75 psia] for vessels with capacities of 151 m3 [40,000 gal] or greater).

For most chemical and petroleum products, the class to which a given liquid belongs will be obvious. For instance, the vapor pressure of No. 2 fuel oil will not exceed 5.2 kPa (0.75 psia) at normal storage temperatures, and, therefore, vessels storing this liquid would be exempt from all except the monitoring provisions of the standards.

Waste tanks with constantly changing mixtures pose a different issue. While a range of possible vapor pressures will be known, constant minor fluctuations in composition will prevent the determination of the actual vapor pressure without extensive (perhaps daily) testing. However, these fluctuations generally are not so large that under normal operating conditions large daily changes in vapor pressure would be expected. Extensive testing of these liquids would be unduly burdensome to industry without providing a corresponding benefit. Therefore, EPA sought an alternative that would preserve the intent of the requirement without being unreasonably burdensome.

Prior to construction of the vessel, the range of likely liquid compositions will be known, as will the maximum monthly average storage temperature. Given these, it is possible to estimate the vapor pressure of the mixture by Raoult's law:

Pt=äPnXn.

where
Pt=the total vapor pressure.
Pn=the vapor pressure component.
Xn=the mole fraction of a component.

As with all other liquids, if the anticipated liquid composition with the highest vapor pressure is below the monitoring cutoffs, the vessel would be exempt from the vapor pressure monitoring requirements of the standards. . . .

EPA upheld this interpretation of NSPS Subpart Kb as recently as March 27, 2000, where the Agency stated "It was not [EPA's Office of Enforcement and Compliance Assurance]'s intent to exempt wastewater and condensate tanks. As long as the 'storage vessel' applicability criteria are met, NSPS Kb applies." Memorandum from John B. Rasnic, Director for Manufacturing, Energy and Transportation Division, Office of Compliance, to Winston A. Smith, Director, Air, Presticides and Toxics Managment Division, USEPA Region IV, Re: New Source Performance Standard Subpart Kb Applicability to Storage Vessels used in the Pulp and Paper Industry IV (March 27, 2000).

According to the information submitted by Merck, applying Raoult's law would result in each tank having an estimated vapor pressure of less than 1.0 kPa. This is below the Subpart Kb regulatory threshold.

The Versar Report acknowledges, however, that Raoult's law is not a particularly accurate method for calculating the vapor pressure of VOL's in wastewater tanks containing aqueous mixtures of highly dilute VOL's. EPA concurs that in future cases, methods other than Raoult's law should be considered when estimating the vapor pressure in wastewater tanks containing aqueous mixtures with a low percentage of VOL's. NSPS Subpart Kb in fact provides that methods used to calculate the maximum true vapor pressure include not only the three specifically enumerated methods set forth at 40 C.F.R. Sec. 60.111b(f)(1)-(3), but also, "Any other method approved by the Administrator."

At this time, no specific method for estimating the maximum true vapor pressure of dilute VOL's in wastewater streams has been approved by the Administrator. Therefore, despite its acknowledged flaws, the standard reference text method of Raoult's law is the default method to be used until the Administrator (or her delegate) approves a method to be used for dilute aqueous VOL- containing wastewaters.

This decision is supported by the fact that Merck concedes in the Versar Report that these three Merck tanks, along with the other tanks in the AWDS, are subject to the Subpart GGG National Emission Standards for Pharmaceutical Production, 40 C.F.R. Sec. 63.1250 et seq. The two-phase emissions control projects described above, which Merck is installing in response to Subpart GGG, will result in greater emissions reductions from the AWDS than would application of Subpart Kb. Furthermore, once the enhancements to the existing air stripper are complete and operational, a large amount of the VOL's in the Avermectin wastewater will be removed upstream of these three wastewater tanks. Merck has calculated the post-stripper wastewater vapor pressure that will result from the proposed air stripper enhancements using a method that has not yet been approved by the Administrator pursuant to 40 C.F.R. 60.111b(f)(4), but which ultimately may prove to be more accurate than Raoult's law for highly dilute aqueous mixtures of VOL's. Calculations done by Merck using this activity coefficient model combined with equilibrium calculations, indicate that once the enhancements to the air stripper are fully operational, the vapor pressure of the wastewater in the tanks (after much of the VOL's have been removed by the enhanced air stripper) will be less than or equal to 5.0 kPa. This vapor pressure is below the Subpart Kb vapor pressure threshold of 5.2 kPa, at which point the NSPS Subpart Kb control requirements in 40 C.F.R. Sec. 60.112b would not apply to these tanks. We note that using Raoult's law, the calculated vapor pressure would be lower still.

Furthermore, Merck has calculated that full implementation of both phases of the emission reduction project (Merck has already modified six tanks in the AWDS, including tanks TA-870, TA-871 and TA-889) will reduce emissions from the three wastewater tanks from 78.7 tpy to 1.5 tpy. This 98% emissions reduction will surpass the NSPS Subpart Kb control requirement of 95%.

Merck anticipates it can achieve a 93% overall emissions reduction from the entire AWDS (including tanks TA-870, TA-871 and TA-889) by fully implementing both phases of the proposed two- phase project to comply with the revised RACT limits and the Pharmaceutical MACT. This 93% reduction will remove 165 tpy of VOC from the ambient air. If Merck were to implement NSPS Subpart Kb controls at the three AWDS tanks, the estimated reduction in VOC is only 65.8 tpy. Therefore, if NSPS Subpart Kb were applicable to the Merck Cherokee tanks, there would be less environmental benefit than could be achieved from application of RACT and Pharmaceutical MACT requirements.

For all of the above reasons, NSPS Subpart Kb does not apply to the Merck's tanks TA-870, TA-871 and TA-889 at its Cherokee facility. This response has been prepared in consultation with the Office of Regional Counsel and the Office of Enforcement and Compliance Assurance/Office of Compliance. If you have any questions regarding this correspondence, please contact Theresa Horgan of my staff at (215) 814-2126.

Sincerely,

Judith M. Katz, Director
Air Protection Division

cc: Dave Aldenderfer, Program Manager, PADEP-Northcentral Regional Office Craig Evans, Air Pollution Control Engineer, PADEP-Rachel Carson State Office Bldg. Everett Bishop, Office of Enforcement and Compliance Assurance/Office of Compliance Anne Martin, EPA (3AP10) Janet H. Friday, Manager, Merck & Co., Inc.