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MEMORANDUM FOR: REGIONAL ADMINISTRATORS AND STATE PLAN
DESIGNEES

THROUGH: DOROTHY DOUGHERTY
Deputy Assistant Secretary

FROM: THOMAS GALASSI, Director
Directorate of Enforcement Programs

SUBJECT: Process Safety Management of Highly Hazardous Chemicals and
Covered Concentrations of Listed Appendix A Chemicals

This memorandum rescinds and replaces the memorandum of the same title dated June 5, 2015. It clarifies the earlier memorandum, provides additional guidance, and incorporates a new interim citation policy.

This memorandum describes OSHA's enforcement policy on the concentration of a chemical that must be present in a process for the purpose of determining whether the chemical is at or above the threshold quantity listed in Appendix A of the Process Safety Management of Highly Hazardous Chemicals (PSM) standard (29 C.F.R. § 1910.119). It was developed in accordance with the President's August 1, 2013, Executive Order 13650, *Improving Chemical Facility Safety and Security*.

OSHA's Current Enforcement Policy: Maximum Commercial Grade

The PSM standard applies to, among other things, "a process which involves a chemical at or above the specified threshold quantities listed in Appendix A to this section." 29 C.F.R. § 1910.119(a)(1)(i). Appendix A lists 137 chemicals and gives the threshold quantity in pounds for each one. For 11 of the 137 chemicals, a minimum concentration is listed along with the chemical name.¹ The remaining 126 chemicals are listed without reference to any concentration. This has created an issue regarding whether the threshold quantities for Appendix A chemicals without listed concentrations apply only to the chemicals in their undiluted (pure) form, or to

¹ E.g., "Diacetyl Peroxide (Concentration > 70%); "Hydrogen Peroxide (52% by weight or greater)." Appendix A.

mixtures in which the chemicals are present at some concentration. Neither the regulatory text nor regulatory history contains guidance on this question.

Following the 1991 publication of the PSM Final Rule, OSHA issued a series of letters of interpretation and compliance directives on this subject. OSHA's initial position, stated in letters issued in December 1992 and April 1993, was that the threshold quantities in Appendix A "apply only to pure (or 'chemical grade') chemicals unless otherwise stated in the appendix."² But in another letter issued in June 1993, OSHA appeared to modify this position stating:

The substances listed in Appendix A without specified concentration limits are intended to be covered by the PSM Standard at commercial grade percentages of purity because the commercial grade of most of the [highly hazardous chemicals] HHC's is approximately 99 percent purity. Many of the HHC's, if not actually at 99% purity, are only one to two percent less than 99 percent pure. For example, the commercial grades of acrolein and allyl chloride are 97 percent purity. Some of these HHC's are considerably less than 99 percent pure.³

In 1994, OSHA further refined its policy, stating that the chemicals listed in Appendix A without minimum concentrations are covered at "commercial grade" concentrations and higher. The letter defined "commercial grade" as "a typical maximum concentration of the chemical that is commercially available and shipped." OSHA also noted that an employer could determine the maximum commercial concentration by referring to any published catalog of chemicals for commercial sales.⁴ OSHA PSM compliance directives issued during this period contain similar statements describing the agency's policy.⁵

² Letter of Interpretation to Shari Roney, April 14, 1993 (available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21091). See also Letter of interpretation to David L. Walker, December 21, 1992 (available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=20963).

³ Letter of Interpretation to F.L. Lambert, June 22, 1993 (available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21176).

⁴ Letter of Interpretation to David B. Smith, March 21, 1994 (available at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21427). See also PSM Applicability to a 50% Solution of Hydroxylamine, April 30, 1999 (available at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=22736).

⁵ See the 1992 and 1994 PSM compliance directives (CPL 02-02-045) (available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=1559 (1992) and http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=1558 (1994)).

OSHA's policy as set forth in these letters of interpretation is ambiguous on several key issues. First, it is not clear whether the threshold quantity of a chemical without a specified concentration must be accounted for under the standard if the commercial grade concentration is significantly less than 99 percent or the chemical is used in the process at a concentration that is greater or lesser than maximum commercial grade concentration. Second, it is not clear whether the threshold quantity of a chemical in a mixture (e.g., a solution containing the chemical and a solvent) includes only the weight of the chemical or includes the weight of the mixture as a whole.

These and other inconsistencies in OSHA's policy led to the dismissal of a criminal indictment in a case involving a 1999 explosion at Concept Sciences Inc. in Allentown, Pennsylvania. *U.S. v. Ward*, No. Crim. 00-681, 2001 WL 1160168, at *11-*17 (E.D. Pa., Sept. 5, 2001). The case involved the PSM standard's coverage of a process using a solution of hydroxylamine at a concentration of 86.5 percent. At the time, the maximum commercial grade concentration of hydroxylamine was 50 percent. The quantity of hydroxylamine in the process exceeded the threshold quantity in Appendix A only if the weight of the water in the hydroxylamine solution was included. The district court found that Concept Sciences' president, Chip Ward, lacked reasonable notice that the standard applied to the process because OSHA's interpretive guidance was ambiguous as to the concentration level at and above which hydroxylamine is covered. *Id.* at 9-12. The court noted that the June 22, 1993 interpretive letter could be read to mean that a process involving an Appendix A chemical without a specified concentration is covered by the standard only if the chemical concentration is near 99 percent purity. *Id.* at 12. The court also found that OSHA's interpretation letters were unclear whether the threshold quantity of a chemical in solution includes the weight of the solvent. *Id.* at 14-17. As a result of this lack of clarity, the court found that the standard could not be enforced against Ward in these circumstances.

OSHA's Reconsideration of the Maximum Commercial Grade Policy

Pursuant to E.O. 13650, OSHA undertook a critical review of its commercial grade policy to identify necessary changes. OSHA was concerned not only with clarifying the policy, but also assuring its consistency with the protective purposes of the standard. In particular, OSHA was concerned that the policy does not adequately account for the potential that the chemicals listed in Appendix A without specified concentrations may retain their hazardous characteristics even at relatively low concentrations.

In addressing this question, OSHA considered the Environmental Protection Agency's (EPA) experience in implementing provisions of the Clean Air Act Amendments of 1990 (CAAA) relating to the public health and environmental impacts of releases of hazardous chemicals. The CAAA required EPA to develop a list of substances that would likely be hazardous to the public or the environment if released, and promulgate regulations and guidance on the prevention and mitigation of such releases. Pursuant to notice and comment procedures, EPA promulgated a List of Regulated Toxic Substances and Threshold Quantities for Accidental Release Prevention. 59 Fed. Reg. 4478-01 (January 31, 1994). EPA has also issued regulations requiring that regulated entities develop and submit Risk Management Plans (RMPs) which must include a hazard assessment, a prevention program, and an emergency response program. In promulgating

the rule, EPA addressed the concentration at which a dilute solution of a substance may pose a hazard sufficient to require a determination regarding whether a threshold quantity is present in a process. 59 Fed Reg. 4488. EPA concluded that, for a few chemicals, it could determine specific cut-off concentrations below which the chemicals need not be considered in determining whether a threshold quantity is present. The remaining substances, EPA found, could reasonably be considered to be hazardous in concentrations at or above one percent, if present in a process at the threshold quantity, unless the partial pressure of the substance was less than 10 millimeters of mercury (10 mm Hg.). *Ibid.* Accordingly, the EPA rule includes a provision requiring that if a listed substance with no specified cut-off concentration is present in a mixture at a concentration of one percent or greater by weight, the threshold quantity of the substance must be determined unless the owner or operator can demonstrate that the partial pressure of the substance under all conditions in the process is below 10 mm Hg. 40 C.F.R. 68.115(b)(1).

OSHA believes that the one percent concentration cut-off established in the EPA rule is the appropriate policy on the concentration of an Appendix A chemical that must be present in a mixture before the threshold quantity of the chemical must be determined. Both the PSM standard and EPA's Risk Management Program are intended to prevent, or ameliorate the effects of, catastrophic releases of hazardous chemicals. EPA's conclusion, following notice and comment, that even one percent solutions of regulated substances may reasonably be anticipated to cause effects of concern in an accidental release is highly relevant. The current maximum commercial grade policy provides no clear threshold above which a chemical mixture is covered, and could permit dangerous concentrations of hazardous chemicals in mixtures to be exempted from PSM coverage.

The commercial grade approach is also confusing for employers attempting to apply the standard. To determine the commercial grade for an Appendix A listed chemical, employers must determine the maximum concentration at which the listed chemical is commercially available for industrial use. Although this can be done with catalogs or by contacting chemical suppliers, undertaking such a process can be difficult because it requires employers: (1) to know and understand the entirety of the supply chain for a particular HHC and (2) to make a determination as to the maximum commercial grade without a means of verifying whether the determination is correct.

OSHA's New Enforcement Policy: the One Percent Test

To better address the hazards associated with mixtures of Appendix A HHCs, OSHA hereby rescinds the maximum commercial grade or pure (chemical) grade policy and adopts a one percent test similar to that adopted by EPA. The new enforcement policy is as follows:

In determining whether a process involves a chemical (whether pure or in a mixture) at or above the specified threshold quantities listed in Appendix A, the employer shall calculate:

(a) the total weight of any chemical in the process at a concentration that meets or exceeds the concentration listed for that chemical in Appendix A, and

(b) with respect to chemicals for which no concentration is specified in Appendix A, the total weight of the chemical in the process at a concentration of one percent or greater. However, the employer need not include the weight of such chemicals in any portion of the process in which the partial pressure of the chemical in the vapor space under handling or storage conditions is less than 10 millimeters of mercury (mm Hg). The employer shall document this partial pressure determination.

In determining the weight of a chemical present in a mixture, only the weight of the chemical itself, exclusive of any solvent, solution, or carrier is counted.

A few examples illustrate the new policy's application. If a process involves a 2000-pound mixture of 50 percent chloropicrin by weight and an appropriate solvent, the following formula determines coverage:

Weight x [concentration] = amount of highly hazardous chemical
2000 pounds x 50 percent = 1000 pounds chloropicrin
1000 pounds exceeds the 500-pound threshold quantity in Appendix A.

For a chemical with a listed concentration, the same formula applies. For example, if a process involves a 10,000 pound mixture of 70 percent diacetyl peroxide and an appropriate solvent, the calculation is as follows:

Weight x [concentration] = amount of highly hazardous chemical
10000 pounds x 70 percent = 7000 pounds of diacetyl peroxide
7000 pounds exceeds the 5000-pound threshold quantity.

But, in contrast, 5000 pounds of 70 percent diacetyl peroxide is not covered:

Weight x [concentration] = amount of highly hazardous chemical
5000 pounds x 70 percent = 3500 pounds of diacetyl peroxide
3500 pounds is less than the 5000-pound threshold quantity.

OSHA notes that where an entry in Appendix A is listed as "anhydrous," it does not cover aqueous solutions or aqueous mixtures. Anhydrous means "containing no water" or "without water." Thus, by definition, Appendix A to PSM does not cover aqueous solutions or aqueous mixtures of chemicals specifically listed as "anhydrous." In addition, although not specifically designated as "anhydrous," OSHA has interpreted Appendix A to mean that the PSM standard does not cover Hydrogen Chloride (CAS 7647-01-0) and/or Hydrogen Fluoride (CAS 7664-39-3) in aqueous solutions or aqueous mixtures.⁶ Therefore, the following entries in Appendix A are not covered when in aqueous solutions or aqueous mixtures:

⁶ Hydrofluoric acid (specifically designated in Appendix A of the PSM standard as "anhydrous") and hydrogen fluoride both are listed in Appendix A of the PSM standard with the same Chemical Abstract Number and threshold quantities. OSHA letters of interpretation state that anhydrous hydrofluoric acid and hydrogen fluoride are the same hazardous chemical (see Letter of Interpretation to Robert Rusczyk, May 18, 1994 (available at

- (1) Ammonia, Anhydrous (CAS 7664-41-7)⁷;
- (2) Dimethylamine, Anhydrous (CAS 124-40-3);
- (3) Hydrogen Cyanide, Anhydrous (CAS 74-90-8);
- (4) Methylamine, Anhydrous (CAS 74-89-5);
- (5) Hydrochloric Acid, Anhydrous/ Hydrogen Chloride (CAS 7647-01-0); and
- (6) Hydrofluoric Acid, Anhydrous/ Hydrogen Fluoride (CAS 7664-39-3).

In such cases, the listing in Appendix A covers only the anhydrous form of the chemical.

Furthermore, OSHA finds that aqueous mixtures of hydrogen bromide (at concentrations below 63%) and mixtures of alkylaluminum (at any concentration) will fall within the partial pressure exemption under all normal handling and storage conditions.

Attachment A of this memorandum gives questions and answers to typical situations compliance officers may encounter in determining the concentration of an HHC for PSM coverage.

Effect of this Memorandum on Prior Guidance

OSHA hereby rescinds all prior statements (including statements in directives, letters of interpretation, and memoranda) related to Appendix A of the PSM standard to the extent they are inconsistent with the one percent policy. OSHA specifically clarifies that the following letters of interpretation are unaffected by this memorandum and are currently good statements of OSHA policy:

1. Letter of Interpretation to Frank Samartinov, June 24, 1992 (available at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=20717) (hydrochloric (muriatic) acid not covered by the PSM standard);
2. Letter of Interpretation to David Smith (Question 1 only), March 21, 1994 (available at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21427) (hydrochloric (muriatic) acid not covered by the PSM standard);

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21487). Hydrochloric acid (specifically designated in Appendix A of the PSM standard as “anhydrous”) and hydrogen chloride both are listed in Appendix A of the PSM standard with the same Chemical Abstract Number and threshold quantities. OSHA letters of interpretation state that anhydrous hydrochloric acid and hydrogen chloride are the same substance (see Letter of Interpretation to Thomas Grumbles, March 25, 1992 (available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=20603)). In accordance with these letters of interpretation, aqueous hydrochloric acid (also known as muriatic acid) and aqueous hydrofluoric acid are not covered by the PSM standard.

⁷ There is a separate entry in Appendix A for “Ammonia solutions (>44% ammonia by weight)”, which covers aqueous ammonia mixtures of greater than 44% concentration.

3. Letter of Interpretation to Ernie Woody, Jan. 21, 1993 (available at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=20995) (hydrochloric (muriatic) acid not covered by the PSM standard);
4. Letter of Interpretation to Robert Rusczek, May 18, 1994 (available at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21487) (aqueous solutions of hydrogen fluoride not covered by the PSM standard);
5. Letter of Interpretation to Gerald Lancour, Jan. 28, 1994 (available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21377) (aqueous solutions of hydrogen fluoride not covered by the PSM standard);
6. Letter of Interpretation to Cary Franklin, June 28, 1992 (available at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=20727) (formaldehyde mixtures at concentrations below 37% not covered by the PSM standard);
7. Letter of Interpretation to Jon LaRue, June 24, 1993 (available at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21180) (discussion of PSM coverage for sulfuric acid and oleum/fuming sulfuric acid).
8. Letter of Interpretation to Thomas Grumbles, March 25, 1992 (available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=20603) (hydrogen chloride/hydrochloric acid, anhydrous are the same substance).

Interim Enforcement Policy

Through March 31, 2017, OSHA will not cite any employers for violations of the PSM standard based on this memorandum (or the prior memorandum dated June 5, 2015). However, during this time period, PSM citations may still be issued based on the previous “commercial grade concentration” policy, under which OSHA considers the total weight of the chemical in the process at commercial grade concentrations and higher.

Through March 31, 2018, with respect to processes that will be covered by the PSM standard for the first time as a result of the one percent test, OSHA will make it a top priority for Compliance Assistance Specialists (CASs) in its Area Offices to provide assistance, when requested, to help employers bring such processes into PSM compliance. Eligible employers can also seek assistance from OSHA’s On-site Consultation Program. To the extent relevant expertise is available among consultation program personnel, requests for assistance with these processes should be a high priority for receiving on-site consultation visits.

From April 1, 2017, through March 31, 2018, the following policies will apply with respect to processes that are covered by the PSM standard for the first time as a result of the one percent test:

- (1) OSHA will not conduct programmed inspections of such processes.
- (2) OSHA will not cite an employer under the PSM standard for any PSM violations involving such processes provided the employer is making good faith efforts to come into compliance with the PSM standard by March 31, 2018. OSHA will consider efforts made by employers to be “in good faith” if they can demonstrate that ongoing efforts to comply with the standard are underway and documented. This policy does not apply in cases involving a fatality or catastrophe.
- (3) Any citations involving PSM violations at such processes shall be submitted to the OSHA Regional Office prior to issuance to ensure consistency and clarity. For cases where the Regional Office needs assistance in its review, it shall consult with OSHA’s Directorate of Enforcement Programs – Office of Chemical Process Safety and Enforcement Initiatives.

Attachment A

Question 1: A process comprises 1,000 pounds of a mixture containing ten percent diborane (CAS 19287-45-7) by weight. Is the process covered by PSM?

OSHA Response: Yes. Ten percent by weight of 1,000 pounds is 100 pounds of diborane. The threshold quantity of diborane is 100 pounds, therefore the process is covered under PSM.

Question 2: A process comprises 10,000 pounds of 50 percent diacetyl peroxide solution. Is the process covered by PSM?

OSHA Response: No. Diacetyl peroxide is specifically listed in Appendix A at concentrations greater than 70 percent. Therefore, solutions containing diacetyl peroxide at less than 70 percent are not covered by PSM regardless of the aggregate amount of the highly hazardous chemical.

Question 3: An employer shows that his process containing 11,000 pounds of a three percent HHC solution has an HHC partial pressure of 7mmHg. The threshold quantity of the HHC is 100 pounds. Is the process covered by PSM?

OSHA Response: No. Although HHC is present at a concentration above one percent, and in a threshold quantity exceeding 100 pounds, the employer need not count the threshold quantity because it has shown that the partial pressure of the chemical in the process is less than 10 mmHg. To calculate this, the employer measures the vapor space pressure at 14.7 psia (760 mmHg) and determines, through analysis, that HHC makes up less than 0.9 mole percent of the vapor. Therefore, the HHC partial pressure is $760 \text{ mmHg} \times 0.009 = 7 \text{ mmHg}$.

Question 4: A portion of an interconnected process contains a mixture with less than one percent of the covered HHC. Does this mean that this portion of the process is not covered under PSM?

OSHA Response: No. An interconnected process is a single process for purposes of coverage under PSM; it is either covered or not covered based on whether the weight of one or more HHCs in any portion of the process meets or exceeds the threshold quantity (TQ) in Appendix A. In determining whether HHCs in any portion of an interconnected process meet or exceed the TQ, the employer need not count any HHC present in a mixture at a concentration less than one percent by weight. However, the employer must determine the total weight of any HHC in a mixture at a concentration of one percent or greater in any portion of the process, and if the total weight meets or exceeds the TQ, the process, as a whole, is covered.

In a similar fashion, the EPA RMP rule addresses the same concept. At 40 CFR 68.115(b)(1), EPA states that the covered material in the portion of the process where the partial pressure is less than 10 mmHg should not be counted towards the threshold quantity.