Safe Work in Inert Confined Spaces in the Petroleum and Petrochemical Industries

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Foreword

Because inert gas blanketing provides protection while introducing significant associated hazards, many facilities operate on the principle, “If inert entry is not necessary, use another method.” Where inert entry is conducted, this standard provides guidance to aid employers in preparing specific procedures for entering and working safely in inert confined spaces. API 2217A is intended to present good practices required by experienced owners and practiced by specialist service contractors. This standard recognizes that because of its unique nature, the hazards and requirements for inert entry are generally greater than for “normal” permit-required confined space (PRCS) entry. The emphasis is on safe entry work practices and equipment (such as multiple source respiratory protection) which are not necessarily addressed in confined space entry regulations.

NOTE API 2217A is not a compliance document although a number of regulatory requirements are incorporated by reference. In the United States, OSHA regulations are available directly from the internet at www.osha.gov. Facilities outside the United States should review relevant legal requirements in their jurisdiction.

In May 1971, API published Petroleum Safety Datasheet (PSD) 2211, *Precautions While Working in Reactors Having an Inert Atmosphere*. In 1987, API Publication 2217A, *Guidelines for Work in Inert Confined Spaces in the Petroleum Industry*, expanded on the 1971 safety datasheet. A Second Edition appeared in September 1997. The Third Edition, API Standard 2217A, *Guidelines for Work in Inert Confined Spaces in the Petroleum and Petrochemical Industries*, updated prior guidance based on both experience and regulations. That revision included input from both owners and inert entry contract service providers. This Fifth Edition carries forward content from the Fourth Edition, with increased emphasis on safety for nonentrants, inert gas warning properties, and updated references. The essential elements of this publication are based on current industry safe operating practices, consensus standards and regulations. Federal, state, and local regulations or laws may contain additional requirements that must be taken into account.

Several sections of API 2217A refer to the insidious nature of inert gas atmospheres. Oxygen-deficient inert atmosphere gases provide no warning of their deadly nature. Those supervising inert entry are charged with providing hazard information and appropriate warning to those working within and near the inert “hot zone.” Special care must be taken to prevent unplanned inert entry and unplanned rescue attempts.

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The verbal forms used to express the provisions in this document are as follows.

Shall: As used in a standard, “shall” denotes a minimum requirement in order to conform to the standard.

Should: As used in a standard, “should” denotes a recommendation or that which is advised but not required in order to conform to the standard.

May: As used in a standard, “may” denotes a course of action permissible within the limits of a standard.

Can: As used in a standard, “can” denotes a statement of possibility or capability.

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API Standards Department, telephone (202) 682-8000. A catalog of API publications and materials is published annually by API, 1220 L Street, NW, Washington, DC 20005.

Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

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Introduction

Work in an inert confined space presents many unique hazards that may not be encountered in a typical confined space entry. The performance of such work is typically conducted by and the special precautions and equipment necessary are obtained by using specialized contractors qualified and knowledgeable in the requirements for inert confined space entry and work. Inert confined space entries do not occur frequently at individual refining and petrochemical facilities and the decision to perform this work activity must be carefully planned, programmed, reviewed, and approved by the facility/location management before such work takes place.

Safe Work in Inert Confined Spaces in the Petroleum and Petrochemical Industries

1 Scope and Special Considerations

1.1 Scope

This Recommended Practice provides guidance for safely entering and working within and near confined spaces that have inert atmospheres. API 2217A applies to confined spaces that have been intentionally purged with an inert gas until:

— the oxygen level in the vapor space is too low to support combustion, and

— any gases in or at the point of discharge from the confined space are deficient in oxygen such that the mixture is not flammable.

Typical inert entry work in the petroleum and petrochemical industry includes, but is not limited to work to service or replace catalyst in reactors and work in confined spaces where the flammable or toxic atmosphere cannot be removed or made safe by another method (such as atmospheric ventilation).

1.2 Special Considerations

For conformance with this Recommended Practice, the target set for initiation of inert entry is no more than 50 % of minimum oxygen level (O_2) for combustion with a maximum total of 4 % O_2 in the inert space. Conformance with this criteria will limit the lower flammable limit (LFL) to below 10 %. If the oxygen level increases to 5 % after entry, the workers shall be removed from the inerted space. Because of these low oxygen levels, special considerations are necessary for entry into confined spaces with inert atmospheres. These require additional safe work practices that supplement (not replace) established regulatory requirements (as exemplified in the United States by the OSHA permit-required confined spaces (PRCS) and personal protective equipment (PPE) standards.)

Inert confined spaces are, by definition, always permit-required confined spaces (PRCS). However, while inert atmospheres in confined spaces are indeed “immediately dangerous to life or health (IDLH),” the hazard is much more severe and immediate than the often used “30-minute escape” criteria. The sense of smell cannot detect either oxygen or nitrogen, so without instruments, there are no warning properties.

Total loss of respiratory protection in an inert atmosphere can cause immediate incapacitation and result in rapid asphyxiation. Unprotected exposure to these hazards results in impairment of the ability to escape unaided (self-rescue) and the risk of death. Because of this severity, stringent requirements are placed on respiratory protection (triple-redundant air supply using approved equipment.) Special precautions are needed to prevent entry and potential asphyxiation of personnel attempting rescue without proper training, qualifications and equipment.

The fundamental exposure protection and management concepts presented herein are applicable to most situations that involve inert atmospheres in confined spaces in the petroleum and petrochemical industries. The specific work areas of greatest concern are the inert confined space itself and the areas at or near the entrance to, or exhaust from, the inerted space. In the refining and petrochemical industries, planned inert entry work activities often relate to catalytic reactor servicing. Where deliberate entry is made into other intentionally inerted confined spaces, such as tanks, large diameter pipes, or in maritime service, the same principles as required for permit-required confined spaces are applicable (with hazard evaluations and adjustments as required for specific conditions and activities).

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Standard 2015, *Safe Entry and Cleaning of Petroleum Storage Tanks*

API Recommended Practice 2016, *Guidelines and Procedures for Entering and Cleaning Petroleum Storage Tanks*

API Standard 2220, *Contractor Safety Performance Process*

API Recommended Practice 2221, *Contractor and Owner Safety Program Implementation*

ANSI [1]/AIHA [2] Z88.2, *Practices for Respiratory Protection*

ANSI/ASSE [3] Z117.1, *Safety Requirements for Confined Spaces*

ANSI/ASSE Z244, *Control of Hazardous Energy-Lockout/Tagout and Alternative Methods*

ANSI/ACC [4] Z400.1, *Hazardous Industrial Chemicals-Material Safety Data Sheets-Preparation*

CGA [5] G7, *Compressed Air for Human Respiration*

CGA Safety Alert SA-16, *Safety Alert-Blended Breathing Air Fatalities*

NFPA [6] 69, *Explosion Prevention Systems*

NFPA 350, *Guide for Safe Confined Space Entry and Work*

NFPA 326, *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair*

OSHA [7] 29 *CFR* Part 1910.132, *Personal Protective Equipment*

OSHA 29 *CFR* Part 1910.134, *Respiratory Protection*

OSHA 29 *CFR* Part 1910.146, *Permit-Required Confined Spaces*

OSHA 29 *CFR* Part 1910.147, *Control of Hazardous Energy (Lockout/Tagout)*

OSHA 29 *CFR* Part 1910.1000 (and following) Subpart Z, *Toxic and Hazardous Substances*

OSHA 29 *CFR* Part 1910.1200, *Hazard Communication*

3 Terms and Definitions

For the purposes of this document, the following definitions apply.

1 American National Standards Institute, 25 West 43rd Street, New York, New York 10036, (Tel.) 212-642-4900, www.ansi.org.
2 American Industrial Hygiene Association, 2700 Prosperity Avenue, Suite 250, Fairfax, Virginia 22031, www.aiha.org.
3 American Society of Safety Engineers, 1800 East Oakton Street, Des Plaines, Illinois 60018, www.asse.org.
4 American Chemical Council, 1300 Wilson Boulevard, Arlington, Virginia 22209, www.americanchemistry.com.
5 Compressed Gas Association, 4221 Walney Road, Chantilly, Virginia 20151, www.cganet.com.
6 National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts 02269, www.nfpa.org.
7 U.S Department of Labor, Occupational Safety and Health Administration, 200 Constitution Avenue, NW, Washington, DC 20210, www.osha.gov.