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

Downstream Segment

API STANDARD 2217A
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Foreword

Because inert gas blankets provide protection while introducing significant hazards, many facilities operate on the principle, “If inert entry is not necessary, use another method.” Where inert entry is to be conducted, this standard provides guidelines to aid employers in preparing specific procedures for working safely in inert confined spaces. API 2217A guidance is intended to represent good practice as required by experienced owner facilities and practiced by specialist service companies. 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 regulations. Thus, API 2217A is not a compliance document although a number of OSHA regulatory requirements are incorporated by reference. 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 Fourth Edition carries forward content from the Third Edition, with increased emphasis on safety for nonentrants, lack of 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 draw attention 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 warning to those working near the inert “hot zone.” Special care must be taken to prevent unplanned inert entry and ill-conceived rescue attempts, and administrative safeguards are outlined. Section 8.2 specifically addresses the concern for safety of nonentry personnel which is integrated throughout this standard.

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Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. A one-time extension of up to two years may be added to this review cycle. Status of the publication can be ascertained from the 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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1.1 Scope

This standard provides guidelines for safely entering and working in 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 flowing out of the confined space are below flammable or reactive levels.

Typical inert entry work in the petroleum and petrochemical industry includes work to service or replace catalyst in reactors.

1.2 Special Considerations

For conformance with this standard the targets set for initiation of inert entry are less than 10 % lower flammable limit (LFL) and no more than 50 % of minimum oxygen level (O_2) for combustion with a maximum of 4 % O_2. If after entry the oxygen level increases to 5 %, 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 which 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 PRCS. But, 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 NIOSH "30-minute escape" definition. 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 virtually 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 equipment approved by NIOSH or equivalent). Special precautions are needed to prevent entry and potential asphyxiation of nonrescue personnel attempting rescue without proper equipment. [1]

The fundamental exposure protection and management concepts presented should be 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 found in tanks, large diameter pipes or in maritime service the same principles should be applicable (with hazard evaluations and adjustments as required for specific conditions and activities).

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[1] From CSB Bulletin 2003-10-B, *Hazards of Nitrogen Asphyxiation*: "Every year people are killed by breathing 'air' that contains too little oxygen. Because 78 percent of the air we breathe is nitrogen gas, many people assume that nitrogen is not harmful. However, *nitrogen is safe to breathe only when mixed with the appropriate amount of oxygen*. These two gases cannot be detected by the sense of smell. A nitrogen enriched environment, which depletes oxygen, can be detected only with special instruments. If the concentration of nitrogen is too high (and oxygen too low), the body becomes oxygen deprived and asphyxiation occurs."

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. The Bibliography lists other useful sources of relevant information.

API Standard 2220, *Contractor Safety Performance Process*

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

ANSI [2]/AIHA [3] Z88.2, *Practices for Respiratory Protection*

ANSI/ASSE [4] Z117.1, *Safety Requirements for Confined Spaces*

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

ANSI/ACC [5] Z400.1, *Hazardous Industrial Chemicals—Material Safety Data Sheets—Preparation*

CGA G-7 [6], *Compressed Air for Human Respiration*

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

NFPA 69 [7], *Explosion Prevention Systems*

OSHA 29 *CFR* Part 1910.132 [8], *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*

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2 American National Standards Institute, 25 West 43rd Street, New York, New York 10036, (Tel.) 212-642-4900, www.ansi.org. Most ANSI publications are available from ANSI at http://webstore.ansi.org or the secretariat organization indicated or from www.global.ihs.com.

3 American Industrial Hygiene Association, 2700 Prosperity Avenue, Suite 250, Fairfax, Virginia 22031, (Tel.) 703-849-8888, (Fax) 703-207-3561, www.aiha.org.

4 American Society of Safety Engineers, 1800 East Oakton Street, Des Plaines, Illinois 60018, www.asse.org.

5 American Chemical Council, 1300 Wilson Blvd., Arlington, Virginia 22209, (Tel.) 703-741-5000, (Fax) 703-741-6050, www.americanchemistry.com.

6 Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly, Virginia 20151-2923, (Tel.) 703-788-2700, www.cganet.com.

7 National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts 02269-7471, www.nfpa.org.

8 U.S Department of Labor, Occupational Safety and Health Administration, 200 Constitution Avenue, NW, Washington, DC 20210, www.osha.gov.