# NFPA® 820

# Standard for Fire Protection in Wastewater Treatment and Collection Facilities

## 2024 Edition

NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

## IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

NFPA® codes, standards, recommended practices, and guides ("NFPA Standards"), of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in NFPA Standards.

The NFPA disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on NFPA Standards. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making NFPA Standards available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of NFPA Standards. Nor does the NFPA list, certify, test, or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

### REVISION SYMBOLS IDENTIFYING CHANGES FROM THE PREVIOUS EDITION

Text revisions are shaded. A Δ before a section number indicates that words within that section were deleted and a Δ to the left of a table or figure number indicates a revision to an existing table or figure. When a chapter was heavily revised, the entire chapter is marked throughout with the Δ symbol. Where one or more sections were deleted, a • is placed between the remaining sections. Chapters, annexes, sections, figures, and tables that are new are indicated with an *N*.

Note that these indicators are a guide. Rearrangement of sections may not be captured in the markup, but users can view complete revision details in the First and Second Draft Reports located in the archived revision information section of each code at www.nfpa.org/docinfo. Any subsequent changes from the NFPA Technical Meeting, Tentative Interim Amendments, and Errata are also located there.


### ALERT: THIS STANDARD HAS BEEN MODIFIED BY A TIA OR ERRATA

NFPA codes, standards, recommended practices, and guides ("NFPA Standards") may be superseded at any time by the issuance of a new edition, be amended with the issuance of Tentative Interim Amendments (TIAs), or be corrected by Errata. This updating considers the then-current and available information on incidents, materials, technologies, innovations, and methods that develop over time. Therefore, any previous edition may no longer represent the current NFPA Standard on the subject matter. NFPA encourages the use of the most current edition of any NFPA Standard [as it may be amended by TIA(s) or Errata]. An official NFPA Standard at any point in time consists of the current edition of the document, with any issued TIAs and Errata. Visit the "Codes & Standards" section at www.nfpa.org for more information.

## ADDITIONAL IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

### Updating of NFPA Standards

Users of NFPA codes, standards, recommended practices, and guides ("NFPA Standards") should be aware that these documents may be superseded at any time by the issuance of a new edition, may be amended with the issuance of Tentative Interim Amendments (TIAs), or be corrected by Errata. It is intended that through regular revisions and amendments, participants in the NFPA standards development process consider the then-current and available information on incidents, materials, technologies, innovations, and methods as these develop over time and that NFPA Standards reflect this consideration. Therefore, any previous edition of this document no longer represents the current NFPA Standard on the subject matter addressed. NFPA encourages the use of the most current edition of any NFPA Standard [as it may be amended by TIA(s) or Errata] to take advantage of current experience and understanding. An official NFPA Standard at any point in time consists of the current edition of the document, including any issued TIAs and Errata then in effect.

To determine whether an NFPA Standard has been amended through the issuance of TIAs or corrected by Errata, visit the "Codes & Standards" section at www.nfpa.org.

### Interpretations of NFPA Standards

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing the Development of NFPA Standards shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

### Patents

The NFPA does not take any position with respect to the validity of any patent rights referenced in, related to, or asserted in connection with an NFPA Standard. The users of NFPA Standards bear the sole responsibility for determining the validity of any such patent rights, as well as the risk of infringement of such rights, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on NFPA Standards.

NFPA adheres to the policy of the American National Standards Institute (ANSI) regarding the inclusion of patents in American National Standards ("the ANSI Patent Policy"), and hereby gives the following notice pursuant to that policy:

NOTICE: The user's attention is called to the possibility that compliance with an NFPA Standard may require use of an invention covered by patent rights. NFPA takes no position as to the validity of any such patent rights or as to whether such patent rights constitute or include essential patent claims under the ANSI Patent Policy. If, in connection with the ANSI Patent Policy, a patent holder has filed a statement of willingness to grant licenses under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, copies of such filed statements can be obtained, on request, from NFPA. For further information, contact the NFPA at the address listed below.

### Law and Regulations

Users of NFPA Standards should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

### Copyrights

NFPA Standards are copyrighted. They are made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of safe practices and methods. By making these documents available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to these documents.

Use of NFPA Standards for regulatory purposes should be accomplished through adoption by reference. The term "adoption by reference" means the citing of title, edition, and publishing information only. Any deletions, additions, and changes desired by the adopting authority should be noted separately in the adopting instrument. In order to assist NFPA in following the uses made of its documents, adopting authorities are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. For technical assistance and questions concerning adoption of NFPA Standards, contact NFPA at the address below.

### For Further Information

All questions or other communications relating to NFPA Standards and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA standards during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101; email: stds_admin@nfpa.org.

For more information about NFPA, visit the NFPA website at www.nfpa.org. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/docinfo.

**NFPA® 820**

**Standard for**

# Fire Protection in Wastewater Treatment and Collection Facilities

**2024 Edition**

This edition of NFPA 820, *Standard for Fire Protection in Wastewater Treatment and Collection Facilities,* was prepared by the Technical Committee on Wastewater Treatment Plants. It was issued by the Standards Council on April 23, 2023, with an effective date of May 13, 2023, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 820 was approved as an American National Standard on May 13, 2023.

## Origin and Development of NFPA 820

The Committee on Wastewater Treatment Plants was organized in 1983 to have primary responsibility for documents on safeguarding against the fire and explosion hazards specific to wastewater treatment plants and their associated collection systems. This document includes the hazard classifications of specific areas and processes. The need to develop NFPA 820 was based on fire or explosion incidents that, while infrequent, were relatively severe. Initial work on the document was begun early in 1985 and the first edition was issued in 1990.

Extensive changes were made between the first edition and the second edition in 1992, with the most notable revision being the document title, which was changed from *Recommended Practice for Fire Protection in Wastewater Treatment Plants* to *Recommended Practice for Fire Protection in Wastewater Treatment and Collection Facilities*. In addition, the scope of the document was revised to include storm sewer systems and their appurtenances.

In 1995 the document was changed from a recommended practice to a standard with mandatory requirements. This was done because NFPA 820 was widely referenced by various jurisdictions.

The 1999 edition of NFPA 820 was changed to include some editorial corrections and make the document more enforceable. The definitions were also modified to conform with NFPA's *Manual of Style*.

For the 2003 edition, the entire document was reformatted to conform to the *Manual of Style for NFPA Technical Committee Documents*. In addition, the definitions were revised to conform with the NFPA *Glossary of Terms*.

The 2008 edition included guidance on waste gas burners and enclosed aeration basins. In addition, the definitions were updated in coordination with the NFPA *Glossary of Terms*.

The 2012 edition incorporated editorial changes to Table 5.2, Table 6.2(a), and Table 6.2(b). A new definition was added for waste gas burners and mitigation steps were added to Section 10.11 on fire and explosion prevention control procedures. Ventilation requirements and supporting language were also revised to provide clarity and better coordinate with associated industry documents.

For the 2016 edition, all the tables were reformatted for better readability and reviewed and revised to provide clearer guidance on when the requirements applied. Combustible gas detector requirements were modified in several locations in the tables. Construction requirements throughout the document were also revised to indicate that building codes cover general building construction, while the components of wastewater facilities are covered by the requirements provided in the chapter tables. The 2016 edition also required alarm signaling for combustible gas detectors and ventilation, as those systems are critical in preventing fires and explosions. Finally, the document was revised to better indicate conditions under which dual ventilation can be used.

The 2020 edition was updated to cover the protection of pressure sewers. All the caution text throughout the document was moved to the annex and new sections were added to emphasize the importance of monitoring for flammable atmospheres prior to the performance of work that could introduce a source of ignition. In addition, the definition for *physical separation* was updated to clarify that personnel entry into physically separated spaces is by individual, exterior access ports with no physical connection. Finally, the 2020 edition was changed to permit the use of an airlock as an alternative means of providing physical separation.

In the 2024 edition, the scope of the standard has been revised to address the accumulation of flammable gases and vapors. Annex material has also been added to provide users with reference materials for conducting a process hazard analysis. The definition term *constantly attended locations* has been changed to *constantly monitored location* to reflect that these locations are not always physically attended. Further, the definitions for *combustible liquid* and *flammable liquid* have been revised and the term *flammable and combustible liquids* has been changed to *ignitible (flammable and combustible) liquid* throughout the document to correspond with NFPA 30, *Flammable and Combustible Liquids Code*.

In Chapter 4, the general requirements have been revised to clarify that the chapter refers to all facilities and systems. Tables 4.2.2 and 6.2.2 have been updated to better clarify the classified areas and ventilation requirements. In addition, revisions have been made to the figures in Section A.4.2 to align with the corresponding rows in Table 4.2.2. In Chapter 7, changes have been made to better clarify the requirements for applying ventilation monitoring systems and quarterly testing requirements, as well as the requirements for ventilation systems to indicate any occurrence of inadequate ventilation. The requirements in Chapter 8 have been revised to change the order of the materials of construction listed in 8.2.3 and provide a definition and description of low flame spread materials.

In addition, Chapter 10 has been revised to add new requirements and supporting annex material to explain the elements of fire and explosion risk assessments, update the minimum frequency of fire inspections, clarify that facility operators and owners must conduct the system tests necessary to bring systems back into service following an impairment, clarify specific requirements for establishing a fire brigade, provide the minimum annual requirement for meetings between plant personnel and the local fire department, and add new requirements for flame-resistant and arc-rated clothing where flammable atmospheres are present. The term *belowgrade* has been changed to *belowgrade or partially belowgrade* throughout the document to allow for the inclusion of partially belowgrade pits, wells, or similar structures. New supplementary classifications of liquids have also been added in the annex. Finally, the requirements for water-based fire protection systems, other fire protection systems, and impairments have been moved from Chapter 10 to Chapter 7 to consolidate all the fire and explosion prevention and protection measures in the same chapter.

## Technical Committee on Wastewater Treatment Plants

**Glenn E. McGinley, II,** *Chair*
Ohio Public Employment Risk Reduction Program, OH [E]

**Norman Bartley,** Hazen Sawyer PC, NY [SE]
**Josef Berktold,** Donohue Associates, WI [U]
Rep. Water Environment Federation
**Marty Cole,** Hubbell Canada LP, Canada [M]
**Scott R. Connor,** Team-1 Academy Inc., Canada [SE]
**Bradley A. Cyrus,** The Gorman-Rupp Company, OH [M]
Rep. Water & Wastewater Equipment Manufacturers Assn., Inc.
**Kevin Enfinger,** ADS Environmental Services LLC, AL [M]
**Claudio C. Groppetti,** Honeywell/Xtralis, Inc., MN [M]
**Leigh Ann Grosvenor,** City of Deltona, FL [E]
**Regina Hanson,** Varec Biogas, CA [M]
**John N. Harrell,** Wilson & Company, Inc., MO [SE]
**Linda Leong,** San Francisco Public Utilities Commission, CA [U]
**Christine Minor,** City of Toledo, Division of Water Reclamation, OH [U]
**Diep T. Nguyen,** DTN Engineers, Inc., CA [SE]
**Dennis Michael Querry,** Trinity River Authority, TX [U]
Rep. Independent Electrical Contractors, Inc.
**Sam Rizzi,** Jacobs/CH2M HILL, OH [SE]
**William J. Ryan, Jr.,** CDM Smith, MA [SE]
**Zach Sachsenmaier,** HDR, Inc., NE [SE]
**Karl Wiegand,** Victaulic/Globe Fire Sprinkler Corporation, MI [M]
Rep. National Fire Sprinkler Association

**Alternates**

**Jeff Leano,** City And County of San Francisco, CA [U]
(Alt. to Linda Leong)
**James Lewis,** American Fire Sprinkler Corporation, KS [M]
(Alt. to Karl Wiegand)
**John R. Puskar,** Prescient Technical Services LLC, OH [SE]
(Alt. to Diep T. Nguyen)

**Nonvoting**

**James F. Wheeler,** Washington, DC [O]
(Member Emeritus)

**Matthew Barker,** NFPA Staff Liaison

*This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.*

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

**Committee Scope:** This Committee shall have primary responsibility for documents on criteria for safeguarding against the fire and explosion hazards specific to wastewater treatment plants and associated collection systems, including the hazard classification of specific areas and processes.

## Contents

**NFPA 820**

**Standard for**

# Fire Protection in Wastewater Treatment and Collection Facilities

**2024 Edition**

***IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Standards." They can also be viewed at www.nfpa.org/disclaimers or obtained on request from NFPA.***

***UPDATES, ALERTS, AND FUTURE EDITIONS: New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with all TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by TIAs or Errata, please consult the National Fire Codes® Subscription Service or the "List of NFPA Codes & Standards" at www.nfpa.org/docinfo. In addition to TIAs and Errata, the document information pages also include the option to sign up for alerts for individual documents and to be involved in the development of the next edition.***

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex F.

## Chapter 1 Administration

### 1.1 Scope.

**1.1.1* General.** This standard shall establish minimum requirements for protection against fire and explosion hazards in wastewater treatment plants and associated collection systems, including the hazard classification of specific locations and processes.

**1.1.2** This standard shall apply to the following:

(1) Collection sewers
(2) Trunk sewers
(3) Intercepting sewers
(4) Combined sewers
(5) Storm sewers
(6) Pumping stations
(7)* Wastewater treatment plants
(8) Sludge-handling facilities
(9) Chemical-handling facilities
(10) Treatment facilities
(11) Ancillary structures *(see 3.3.60.1)*

**1.1.3** This standard shall not apply to the following:

(1) On-site treatment systems *(see 3.3.44)*
(2) Building drain systems and appurtenances *(see 3.3.6)*
(3) Industrial sewer systems and appurtenances *(see 3.3.54.5)*
(4) Personnel safety from toxic and hazardous materials or products of combustion
(5) Separate nonprocess-related structures *(see 3.3.60.2)*

### 1.2 Purpose.

**1.2.1** The purpose of this standard shall be to provide a degree of fire and explosion protection for life, property, continuity of mission, and protection of the environment.

**1.2.2** The purpose of this standard shall be to reduce or eliminate fire or explosion due to the accumulation of flammable gases and vapors by maintaining structural integrity, controlling flame spread and smoke generation, preventing the release of toxic products of combustion, and maintaining serviceability and operation of the facility.

### 1.3 Application.

**1.3.1 Installations and Modifications.** The requirements of this standard shall apply to new installations or changes in use of a space, electrical hazard classification, or process capacity.

**1.3.1.1** Replacement-in-kind of components or devices are not considered modifications.

**1.3.1.2*** The requirements of this standard shall be used in a risk assessment to identify the areas identified in 1.1.2 that are vulnerable to fire or other loss.

**1.3.2 Toxicity and Biological Hazards.**

**1.3.2.1** This standard shall apply to the fire and explosion hazards of various substances associated with wastewater treatment and conveyance.

**1.3.2.2*** This standard shall not apply to toxicity and biological hazards.

**1.3.3 Ventilation Practices.** Ventilation rates required by this standard are deemed only to minimize fire and explosion hazards. *(See also 1.3.2.2, 9.1.1.2, and A.9.1.1.2.)*

**1.3.4* Materials Selection.** When conditions or applications warrant the selection of combustible, limited-combustible, or low flame spread index materials, the fire risk assessment shall include evaluation of flame spread, smoke generation, and the impact that a fire or explosion will have on the structural integrity of the facility. *(See Section 10.3.)*

**1.4 Retroactivity.** The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

**1.4.1** Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

**1.4.2** In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permit-

ted to apply retroactively any portions of this standard deemed appropriate.

**1.4.3** The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

**1.5 Equivalency.** Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

**1.5.1** Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

**1.5.2** The system, method, or device shall be approved for the intended purpose.

**1.6 Units and Formulas.** Metric units of measurement used within this standard are in accordance with the modernized metric system known as the International System of Units (SI).

**1.6.1** Values of measurement are followed by an approximate equivalent value in US customary units.

**1.6.2** For metric conversion practices, see IEEE/ASTM SI 10, *American National Standard for Metric Practice*.

**1.7 Document Organization.** This document shall be divided into 10 chapters.

**1.7.1** Chapters 1, 3, 7, 8, 9, and 10 shall apply generally.

**1.7.2** Chapters 4, 5, and 6 shall apply to specific processes and functions.

**1.8* *National Electrical Code*® Criteria.**

**1.8.1** NFPA 820 is based on the criteria established by Article 500 of *NFPA 70* but shall not supersede or conflict with the requirements therein.

**1.8.2** Once a location is classified, it shall comply with the requirements of *NFPA 70*.

## Chapter 2 Referenced Publications

**2.1 General.** The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

**Δ 2.2 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code,* 2024 edition.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2022 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam,* 2024 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 2022 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems,* 2022 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2022 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2024 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection,* 2022 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems,* 2024 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection,* 2022 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection,* 2023 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* 2022 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2023 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2024 edition.

NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals,* 2024 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work,* 2024 edition.

NFPA 54, *National Fuel Gas Code,* 2024 edition.

NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems,* 2023 edition.

NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities,* 2020 edition.

NFPA 68, *Standard on Explosion Protection by Deflagration Venting,* 2023 edition.

NFPA 69, *Standard on Explosion Prevention Systems,* 2024 edition.

*NFPA 70*®, *National Electrical Code*®, 2023 edition.

NFPA *70E*®, *Standard for Electrical Safety in the Workplace*®, 2024 edition.

*NFPA 72*®, *National Fire Alarm and Signaling Code*®, 2022 edition.

NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment,* 2024 edition.

NFPA 85, *Boiler and Combustion Systems Hazards Code,* 2023 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids,* 2020 edition.

NFPA 92, *Standard for Smoke Control Systems,* 2024 edition.

NFPA *101*®, *Life Safety Code*®, 2024 edition.

NFPA 204, *Standard for Smoke and Heat Venting,* 2024 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations,* 2022 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials,* 2023 edition.

NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth,* 2024 edition.

NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas,* 2024 edition.

NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas,* 2024 edition.

NFPA 600, *Standard on Facility Fire Brigades,* 2020 edition.

NFPA 601, *Standard for Security Services in Fire Loss Prevention,* 2020 edition.

NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,* 2020 edition.

NFPA 770, *Standard on Hybrid (Water and Inert Gas) Fire-Extinguishing Systems,* 2021 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems,* 2023 edition.

NFPA 1142, *Standard on Water Supplies for Suburban and Rural Firefighting,* 2022 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 2022 edition.

NFPA 2112, *Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire,* 2023 edition.

**2.3 Other Publications.**

**2.3.1 ANSI Publications.** American National Standards Institute, Inc., 25 West 43rd Street, 4th floor, New York, NY 10036.

ANSI/NEMA Z535.2, *Environmental and Facility Safety Signs,* 2011 (R2017).

**2.3.2 ASTM Publications.** ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D5/D5M, *Standard Test Method for Penetration of Bituminous Materials*, 2020.

ASTM D4359, *Standard Test Method for Determining Whether a Material is a Liquid or a Solid*, 2019.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* 2022.

ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C,* 2019a.

ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C,* 2018.

ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, 2022.

IEEE/ASTM SI 10, *American National Standard for Metric Practice,* 2016.

Δ **2.3.3 UL Publications.** Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 723, *Test for Surface Burning Characteristics of Building Materials,* 2018.

**2.3.4 Other Publications.**

*Merriam-Webster's Collegiate Dictionary*, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2020.

**2.4 References for Extracts in Mandatory Sections.**

NFPA 30, *Flammable and Combustible Liquids Code,* 2021 edition.

*NFPA 70®, National Electrical Code®,* 2023 edition.

NFPA *101®, Life Safety Code®,* 2021 edition.

NFPA 652, *Standard on the Fundamentals of Combustible Dust,* 2019 edition.

NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials,* 2020 edition.

NFPA 1670, *Standard on Operations and Training for Technical Search and Rescue Incidents,* 2017 edition.

*NFPA 5000®, Building Construction and Safety Code®,* 2021 edition.

## Chapter 3 Definitions

**3.1 General.** The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

**3.2 NFPA Official Definitions.**

**3.2.1* Approved.** Acceptable to the authority having jurisdiction.

**3.2.2* Authority Having Jurisdiction (AHJ).** An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

**3.2.3 Labeled.** Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**3.2.4* Listed.** Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

**3.2.5 Shall.** Indicates a mandatory requirement.

**3.2.6 Should.** Indicates a recommendation or that which is advised but not required.

**3.2.7 Standard.** An NFPA standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA manuals of style. When used in a generic sense, such as in the phrases "standards development process" or "standards development activities," the term "standards" includes all NFPA standards, including codes, standards, recommended practices, and guides.

**3.3 General Definitions.**

**3.3.1 Activated Carbon.** Adsorptive carbon particles or granules usually obtained by heating carbonaceous material in the absence of air or in steam and possessing a high capacity to selectively remove trace and soluble components from solution.

**3.3.2 Adjacent.** Sharing a common wall, partition, or barrier.

**3.3.3 Airlock.** A means of egress, consisting of interdependent doors designed to maintain the internal pressure of the room to prevent or significantly reduce re-entry of a surrounding explosive atmosphere.

**3.3.4* Anaerobic Digestion.** A unit process designed to biologically convert organic matter (sludge) through the action of microorganisms in the absence of elemental oxygen.

**3.3.5 Building.** Any structure used or intended for supporting or sheltering any use or occupancy. [***101***, 2021]

**3.3.6 Building Drain.** In plumbing, the part of the lowest horizontal piping of a drainage system that receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer (house connection or lateral).

**3.3.7 Centrifuge.** A mechanical device in which centrifugal force is used to separate solids from liquids or to separate liquids of different densities.

**3.3.8 Classification of Locations.**

**3.3.8.1** ***Classified Location.*** A space where a flammable gas, flammable liquid–produced vapor, combustible liquid–produced vapors, combustible dusts, or combustible fibers/flyings could be present, and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section, or area is considered individually in determining its classification.

**3.3.8.2** ***Unclassified Location.*** A space that does not meet the definition of a classified location.

**3.3.9 Combustible.** Capable of undergoing combustion.

**3.3.10* Combustible Gas Detector.** A fixed, permanently mounted instrument used to detect the presence of flammable vapors and gases and warn when concentrations approach the explosive range.

**3.3.11 Combustible or Explosive Dust.** A dust capable of spontaneous combustion or of exploding or burning when subjected to a source of ignition.

**3.3.12 Compost.** The product of the thermophilic biological oxidation of sludge or other organic materials.

**3.3.13* Constantly Monitored Location.** An owner or operator-facility that is attended 24 hours a day.

**3.3.14 Dissolved Air Flotation.** A separation process in which air bubbles emerging from a supersaturated solution become attached to suspended solids in the liquid undergoing treatment and float them up to the surface.

**3.3.15 Drying Bed.** A confined, underdrained, shallow layer of sand or gravel structures on which digested sludge is distributed for draining and air drying; also an underdrained, shallow, diked earthen structure used for drying sludge.

**3.3.16 Enclosed Space.** The interior space of any tank or unit process that is closed to the atmosphere, excluding vents or pressure relief, or the area around any open tank or unit process surrounded by a building or other structure constructed with a roof and solid walls.

**3.3.17 Equipment.** In wastewater treatment facilities, a general term that includes items such as material, fittings, devices, appliances, and fixtures and apparatus, used as part of, or in connection with, a mechanical, instrumentation, or electrical installation.

**3.3.17.1*** ***Gas-Handling Equipment.*** Equipment, including gas compressors, sediment traps, drip traps, gas scrubbers, and pressure-regulating and control valves, used in the removal of gas evolved from the anaerobic digestion process and the compression, conditioning, or treatment of such gas.

**3.3.17.2** ***Utilization Equipment.*** Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes. [**70,** 2023]

**3.3.18 Equipment Enclosure.** The housing that covers, protects, or guards a piece of equipment that is not intended for personnel occupancy but that can provide access to the equipment.

**3.3.19 Filter.**

**3.3.19.1** ***Belt Filter.*** A sludge-dewatering or -concentrating device having continuous bands or belts of filtering media that pass around rollers and from which the material caught on the media is usually removed by gravity and pressure.

**3.3.19.2** ***Pressure or Gravity Filter.*** A filter used to pass liquid through a medium to remove suspended solids.

**3.3.19.3** ***Trickling Filter.*** A treatment unit process consisting of stone, plastic, redwood, or similar media over which wastewater is distributed and through which wastewater trickles to the underdrains and is treated by the microbial slimes formed on the surface of the media.

**3.3.19.4** ***Vacuum Filter.*** A unit process, used to dewater wastewater sludge, consisting of a cylindrical drum mounted on a horizontal axis, covered with a media, and subjected to an internal vacuum.

**3.3.20 Filter Press.** A plate and frame press used in a unit process that is operated hydraulically and mechanically to produce a semisolid sludge cake from a slurry.

**3.3.21 Fire Prevention.** Measures directed toward avoiding the inception of fire. [**801**, 2020]

**3.3.22 Fire Protection.** Methods of providing for fire control or fire extinguishment. [**801**, 2020]

**3.3.23* Flame Spread Index.** A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

**3.3.24 Flash Mixer.** A device for quickly dispersing chemicals uniformly throughout a liquid or semisolid.

**3.3.25 Flocculation.** A unit process used for the formation of floc in wastewater.

**3.3.26 Force Main (Pressure Main).** A pressure pipe connecting the pump discharge of a wastewater pumping station under pressure to a point of discharge.

**3.3.27* Galleries.** Long tunnels or walkways connecting separate buildings or structures that are generally underground, without windows, and with limited entrances and exits.

**3.3.28 Gas.**

**3.3.28.1** ***Digester Gas.*** Gas obtained as a by-product from a controlled anaerobic sludge digestion unit process from the decomposition of organic matter.

**3.3.28.2*** ***Fuel Gas.*** A gas used as a fuel source, including natural gas, manufactured gas, sludge gas, liquefied petroleum gas–air mixtures, liquefied petroleum gas in the vapor phase, and mixtures of these gases.

**3.3.28.3*** ***Sewer Gas.*** Gas resulting from the decomposition of organic matter in wastewater in sewers and from the incidental, uncontrolled release of hydrocarbons or decomposition of organic matter in stagnant liquid and septic sludge in wastewater treatment plants.

**3.3.28.4*** ***Sludge Gas.*** Gas obtained as a by-product of the anaerobic sludge digestion process from the decomposition of organic matter in biosolids in liquid or semi-solid state when stored for extended periods of time.

**3.3.29 Grit Chamber.** A detention chamber or an enlargement of a sewer designed to reduce the velocity of flow of the liquid to permit the separation of mineral from organic solids by differential sedimentation.

**3.3.30 Hydrogen Sulfide ($H_2S$).** A toxic and lethal gas produced in sewers and digesters by anaerobic decomposition of wastewater solids or other anaerobic wastewater or sludge treatment processes.

**3.3.31 Identified (as applied to equipment).** Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular Code requirement. [**70,** 2023]

**3.3.32 Incineration.** Combustion or controlled burning of volatile organic matter in sludge and solid waste that reduces the volume of the material while producing heat, dry inorganic ash, and gaseous emissions.

**3.3.33 Inspection.** A visual examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage.

**3.3.34 Liquid.**

*N* **3.3.34.1** ***Combustible Liquid.*** An ignitible liquid that is classified as a Class II or Class III liquid. *(See 4.2.2 and 4.2.3 of NFPA 30.)* [**30,** 2021]

*N* **3.3.34.2** ***Flammable Liquid.*** An ignitible liquid that is classified as a Class I liquid. *(See 4.2.1 of NFPA 30.)* [**30,** 2021]

*N* **3.3.34.3*** ***Ignitible Liquid.*** Any liquid or liquid mixture that has a measurable closed-cup flash point. [**30,** 2021]

*N* **3.3.34.4*** ***Liquid (Physical State).*** Any material that (1) has a fluidity greater than that of 300 penetration asphalt when tested in accordance with ASTM D5/D5M, *Standard Test Method for Penetration of Bituminous Materials,* or (2) is a viscous substance for which a specific melting point cannot be determined but that is determined to be a liquid in accordance with ASTM D4359, *Standard Test Method for Determining Whether a Material is a Liquid or a Solid.* [**30,** 2021]

*N* **3.3.34.5** ***Liquid Class.*** A uniform system of classifying ignitible liquids. *(See Chapter 4 of NFPA 30.)* [**30,** 2021]

**3.3.34.6** ***Volatile Liquid.*** A liquid that evaporates readily at normal temperature and pressure.

**3.3.35 Lower Explosive Limit (LEL).** See Lower Flammable Limit (LFL) 3.3.36.

**3.3.36 Lower Flammable Limit (LFL).** That concentration of a flammable vapor in air below which ignition will not occur. Also known as the lower explosive limit (LEL). [**30**, 2021]

**3.3.37 Maintenance.** Work performed to ensure that equipment operates as directed by the manufacturer.

**3.3.38 Maintenance Hole.** A structure located on top of an opening in a gravity sewer, or an opening in the top or side of an enclosed vessel to allow personnel entry; also referred to as manhole or manway.

**3.3.39 Material.**

*N* **3.3.39.1** ***Combustible Material.*** See 8.2.3.4.

**3.3.39.2** ***Limited-Combustible Material.*** See 8.2.3.2.

*N* **3.3.39.3** ***Low Flame Spread Index Material.*** See 8.2.3.3.

**3.3.39.4** ***Noncombustible Material.*** See 8.2.3.1.

**3.3.40 Methane ($CH_4$).** A colorless, odorless, flammable gaseous hydrocarbon present in natural gas and formed by the anaerobic decomposition of organic matter. *(See 3.3.4, Anaerobic Digestion.)*

*N* **3.3.41* Normally Unoccupied Building Service Equipment Support Area.** A building service equipment support area in which people are not expected to be present on a regular basis. [***101,*** 2021]

**3.3.42 Not Enclosed.** Any tank or unit process open to the atmosphere or the area around any open tank or unit process housed in a building or other structure constructed with a roof and having at least 50 percent of the wall area open to the atmosphere. Fixed open louvered panels with effective openings greater than 50 percent of the wall area and evenly distributed over the wall area are considered open to the atmosphere.

*N* **3.3.43 Occupiable Area.** An area of a facility occupied by people on a regular basis. [***101,*** 2021]

**3.3.44 On-Site Treatment System.** A self-contained system, including pumping equipment, that provides both treatment and disposal of wastewater on or immediately adjacent to a single residence or group of residences or small commercial establishments.

**3.3.45 Oxygen-Enriched Atmosphere.** Air atmospheres containing more than 23.5 percent oxygen by volume at one standard atmosphere pressure. [**1670**, 2017]

**3.3.46 Ozonation.** The process of contacting wastewater or air with ozone for the purpose of disinfection, oxidation, or odor control.

**3.3.47* Physically Separated.** A gastight partition between two adjacent spaces, or two nonadjacent spaces, with no means of gas communication between the spaces and where personnel entry into the spaces is by individual, exterior access ports with no physical connection, or an airlock.

**3.3.48* Pumping Station.** A structure that contains pumps and appurtenant piping, valves, and other mechanical and electrical equipment for pumping wastewater or other liquid.

**3.3.49 Pyrolysis.** The destructive distillation of organic compounds in an oxygen-free environment that converts the organic matter into gases, liquids, and char.

**3.3.50 Replacement-in-Kind.** A replacement that satisfies the design specifications of the replaced item. [**652,** 2019]

**3.3.51 Rotating Biological Contactor (RBC).** A unit process for wastewater treatment that is composed of large, closely spaced plastic discs that are rotated about a horizontal shaft (usually a secondary biological treatment process).

**3.3.52 Scum or Skimmings.** Grease, solids, liquids, and other floatable material removed from settling tanks.

**3.3.53* Sedimentation.** The unit process of subsidence of suspended matter carried by water, wastewater, or other liquids by gravity.

**3.3.54 Sewer.** A single pipe or system of pipes or conduits that carries wastewater or drainage water.

**3.3.54.1** ***Branch Sewer.*** A sewer that receives wastewater from a relatively small area and discharges into a main sewer serving more than one branch sewer area.

**3.3.54.2** ***Building Sewer.*** In plumbing, a sewer that consists of the extension from the building drain to the public sewer or other place of disposal; also called house connection or lateral.

**3.3.54.3** ***Collector Sewer.*** A sewer that consists of a pipe or conduit that receives wastewater from a relatively small area from two or more lateral sewers and that subsequently discharges into a trunk sewer.

**3.3.54.4** ***Combined Sewer.*** A sewer intended to receive both wastewater and storm or surface water.

**3.3.54.5** ***Industrial Sewer.*** A sewer intended to receive only industrial wastewater or other liquid or water-carried wastes that is located on a private property, owned and operated to carry industry-specific contaminants, and properly treated to federal and state requirements before direct discharge or receives proper pretreatment in accordance with federal or state requirements before discharge to a municipal sewer system. *(See also 3.3.54.8, Sanitary Sewer; 3.3.54.9, Storm Sewer; and 3.3.54.4, Combined Sewer.)*

**3.3.54.6** ***Outfall Sewer.*** A sewer that receives wastewater from a collecting system or from a treatment plant and carries it to a point of final discharge.

**3.3.54.7** ***Residential Sewer.*** A sewer intended to receive only residential, domestic wastewater. *(See also 3.3.54.4, Combined Sewer; 3.3.54.8, Sanitary Sewer; and 3.3.54.9, Storm Sewer.)*

**3.3.54.8** ***Sanitary Sewer.*** A sewer that carries liquid and water-carried wastes from residences, commercial buildings, industrial plants, and institutions together with minor quantities of storm water, surface water, and groundwater that are not admitted intentionally.

**3.3.54.9** ***Storm Sewer.*** A pipe or conduit that carries storm water and surface water, street wash and other wash water, or drainage but that excludes domestic wastewater and industrial wastes (also called storm drain).

**3.3.54.10** ***Trunk Sewer.*** A sewer consisting of the principal pipe or conduit to which one or more collector sewers or branch sewers are tributaries; also called main sewer.

**3.3.55 Sludge.** A semiliquid mass of accumulated settled solids deposited from raw or treated wastewater in tanks or basins; also referred to as biosolids.

**3.3.55.1** ***Activated Sludge.*** A microbial mass grown in aeration tanks, subsequently separated from treated wastewater by sedimentation, and wasted or returned to the process as needed.

**3.3.56 Sludge Cake.** A semisolid product of a sludge-dewatering process.

**3.3.57 Sludge Dewatering.** The process of removing a part of the water in sludge by any physical or mechanical method without heat, such as draining, pressing, vacuum filtration, centrifuging, or passing between rollers.

**3.3.58 Sludge Drying Process.** A process that uses physical or mechanical evaporation techniques with or without the application of heat to achieve solids concentrations greater than 85 percent.

**3.3.59 Sludge Thickening.** A sludge treatment process designed to concentrate wastewater sludges by gravity, mechanical means, or air flotation.

**3.3.60 Structure.** That which is built or constructed and limited to buildings and nonbuilding structures as defined herein. [**5000,** 2021]

**3.3.60.1** ***Ancillary Structure.*** A structure that is an integral part of the wastewater treatment or collection process.

**3.3.60.2** ***Separate Nonprocess-Related Structure.*** A structure that is physically separated and does not contain any process-related equipment associated with the collection and treatment of wastewater and solids derived from wastewater treatment processes.

**3.3.61 Tank.**

**3.3.61.1** ***Imhoff Tank.*** A deep, two-story wastewater treatment tank consisting of an upper continuous-flow sedimentation chamber and a lower sludge digestion chamber.

**3.3.61.2** ***Nitrification Tank.*** A unit process tank for the oxidation of ammonia and nitrogen into nitrates through biochemical actions.

**3.3.62 Treatment.**

**3.3.62.1** ***Anaerobic Wastewater Treatment.*** A unit process providing treatment of the liquid stream by action of microorganisms in the absence of elemental oxygen, the process by-products of which include a gas containing methane, carbon dioxide, and small quantities of hydrogen sulfide.

**3.3.62.2** ***Heat Treatment.*** A sludge-conditioning process combining high temperature, time, and pressure to improve the dewaterability of organic sludge.

**3.3.62.3*** ***Sludge Treatment.*** The processing of wastewater sludges to render them stable.

**3.3.62.4** ***Wastewater Treatment.***

**3.3.62.4.1*** ***Primary Treatment with Skimming.*** The first major treatment in a wastewater treatment plant, generally consisting of screening, comminution or grinding, grit removal, sedimentation, skimming, or any combination of such unit processes.

**3.3.62.4.2** ***Secondary Treatment.*** Wastewater treatment unit processes usually consisting of primary treatment with skimming and biological oxidation using activated sludge or trickling filtration followed by clarification.

**3.3.62.4.3** ***Tertiary Treatment.*** Any physical, chemical, or biological treatment process used to accomplish a degree of treatment greater than that achieved by secondary treatment.

**3.3.63 Tunnel.** See 3.3.27, Galleries.

**3.3.64 Unit Process.** A stage or step in the treatment of wastewater.

**3.3.65 Vault.** An enclosed structure, usually underground, used to permit personnel access to various types of equipment and instrumentation.

**3.3.66 Ventilation Rate.** A value based on the number of air changes per hour and calculated using 100 percent outside air for the supply air that is exhausted. The number of air changes per hour is calculated on the basis of the maximum aggregate volume (under normal operating conditions) of the space to be ventilated.

**3.3.67 Waste.**

**3.3.67.1** ***Industrial Waste.*** Generally liquid, solid, or gaseous wastes originating from the manufacture of specific products.

**3.3.68* Waste Gas Burner (flare).** A safety device used to combust excess digester gas. Waste gas burners reduce the probability of odors or gas explosions caused by excess digester gas directly vented to the atmosphere by pressure-relief valves.

**3.3.69 Wastewater.** The spent water of a community that is a combination of the liquid and water-carried wastes from residences, commercial buildings, industrial plants, and institutions, together with any groundwater, surface water, and storm water that might be present.

**3.3.69.1** ***Domestic Wastewater.*** Wastewater derived principally from sources such as dwellings, commercial establishments, and institutions, that might or might not contain small amounts of groundwater, surface water, or storm water.

**3.3.69.2** ***Residential Wastewater.*** Wastewater derived from areas consisting of single- and multiple-family residences.

**3.3.70 Well.**

**3.3.70.1*** ***Dry Well.*** The portion of a pumping station designed to provide isolation and shelter or accommodations for controls or equipment associated with pumping of wastewater and designed to completely and permanently exclude wastewater or wastewater-derived atmospheres.

**3.3.70.2*** ***Wet Well.*** The portion of the pumping station that receives and temporarily stores wastewater for the purpose of pumping.

## Chapter 4 Collection Systems

**4.1* General.**

Δ **4.1.1** This chapter shall establish minimum criteria for protection against fire and explosion hazards in the collection and transportation of wastewater. *(See 1.1.2.)*

**4.1.2** This chapter shall not apply to on-site systems or those sewers that principally convey industrial wastes.

**4.1.3** When electrical work is performed as permitted in accordance with 130.2(A) of NFPA *70E*, a portable gas detector and an energized electrical work permit shall be required and documented in order to maintain a safe working condition.

**4.1.3.1** The atmosphere in the space shall be maintained below 10 percent of the LFL.

**4.1.4** Before hot work operations such as welding, cutting, and similar spark-producing operations begin in a location that has not been designated for such operations, a portable gas detector and a written hot work permit shall be required and documented as per 5.4.1 of NFPA 51B in order to maintain a safe working condition.

**4.1.4.1** The atmosphere in the space shall be maintained below 10 percent of the LFL.

**4.1.5** A sign that meets the requirements of ANSI/NEMA Z535.2, *Environmental and Facility Safety Signs*, shall be posted at the entrance informing of the potential hazards of a flammable atmosphere in classified locations identified in this chapter.

**4.2* Design and Construction.**

**4.2.1** The design and construction of buildings and structures containing wastewater collection and transport systems shall comply with the applicable building code and the additional requirements in Chapters 7 through 9.

**4.2.2** The design and construction of the components associated with the wastewater collection and transport systems shall conform to Table 4.2.2.

**Δ Table 4.2.2 Collection Systems**

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D) | Materials of Construction[c] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 1 | | MATERIALS USED IN REHABILITATION, RECONSTRUCTION, OR SLIP-LINING OF SEWERS | N/A | N/A | N/A | N/A | In accordance with 8.3.5 | N/A |
| 2 | | INDUSTRIAL SEWER<br>Sewer transporting industrial wastewater only (no sanitary wastewater) | Not included within the scope of this standard | | | | | |
| 3 | | STORM SEWER<br>Sewer transporting storm water only (no sanitary wastewater) | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Inside of sewer | Division 2 | In accordance with 8.3.5 | NR |
| 4 | | STORM WATER PUMPING STATION WET WELLS<br>Liquid side of pumping station serving only a storm sewer system | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Entire room or space plus envelope 0.9 m (3 ft) around vents | Division 2 | NC, LC, or LFS | NR |
| 5 | a | STORM WATER PUMPING STATION DRY WELLS | Buildup of vapors from ignitible (flammable or combustible) liquids | D | Entire dry well plus envelope 0.9 m (3 ft) around vents | Division 2 | NC, LC, or LFS | FE |
| | b | Dry side of a pumping station serving only a storm sewer system and physically separated from wet well | | C | Entire dry well | Unclassified | NC, LC, or LFS | FE |
| 6 | a | FORCE MAIN | Buildup of vapors from ignitible (flammable or combustible) liquids | NNV | Areas within 0.9 m (3 ft) of Air Release Valve and Appurtenances | Division 2 | NC, LC, or LFS | NR |
| | b | Air release valve | | | Areas beyond 0.9 m (3 ft) of Air Release Valve and Appurtenances | Unclassified | NC, LC, or LFS | NR |
| 7 | | BUILDING SEWER<br>(Lateral sewer or drain) Sewer serving a house or single building (plumbing) | Not included within the scope of this standard | | | | | |
| 8 | | INDIVIDUAL RESIDENTIAL SEWER<br>Sewer serving one or more individual residences with a total flow of not more than 5678 L per day (1500 gallons per day (gpd)) | N/A | NNV | Within enclosed space | Unclassified | NR | NR |

*(continues)*

**Δ Table 4.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D) | Materials of Construction[c] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 9 | | INDIVIDUAL RESIDENTIAL PUMPING UNITS<br>Pumping units serving one or more individual residences with a total flow of not more than 5678 L per day (1500 gallons per day(gpd)) (e.g., grinder pumps, septic tank effluent pumps, ejector pumps) | N/A | NNV | Within enclosed space | Unclassified | NR | NR |
| 10 | a | RESIDENTIAL SEWER | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Within enclosed space | Division 2 | In accordance with 8.3.5 | NR |
| | b | Sewer transporting primarily residential wastewater | | B | Within enclosed space | Unclassified | In accordance with 8.3.5 | NR |
| 11 | | OUTFALL SEWER<br>Final discharge pipe from a treatment plant, transporting treated wastewater | N/A | NNV | N/A | Unclassified | NR | NR |
| 12 | a | SANITARY SEWER | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Inside of sewer | Division 1 | In accordance with 8.3.5 | NR |
| | b | Sewer transporting domestic, commercial, and industrial wastewater | | B | Inside of sewer | Division 2 | In accordance with 8.3.5 | NR |
| 13 | a | COMBINED SEWER | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Inside of sewer | Division 1 | In accordance with 8.3.5 | NR |
| | b | Sewer transporting domestic, commercial, and industrial wastewater and storm water | | B | Inside of sewer | Division 2 | In accordance with 8.3.5 | NR |
| 14 | a | WASTEWATER PUMPING STATION WET WELLS | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | A | Entire room or space plus envelope 0.9 m (3 ft) around vents | Division 1 | NC, LC, or LFS | CGD required if mechanically ventilated or opens into a building interior |
| | b | | | A | 1.5 m (5 ft) beyond vent plus envelope 0.46 m (18 in.) extending 0.9 m (3 ft) around openings (hatches or doors) | Division 2 | NC, LC, or LFS | CGD required if mechanically ventilated or opens into a building interior |
| | c | Liquid side of a pumping station serving a sanitary sewer or combined system | | B | Entire room or space plus envelope 0.9 m (3 ft) around vents | Division 2 | NC, LC, or LFS | CGD (if enclosed) |

*(continues)*

**Δ Table 4.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D) | Materials of Construction[c] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 15 | a | BELOWGRADE OR PARTIALLY BELOWGRADE WASTEWATER PUMPING STATION DRY WELL | Buildup of vapors from ignitible (flammable or combustible) liquids | C | Entire space or room | Unclassified | NC, LC, or LFS | FE |
| | b | Pump room physically separated from wet well; pumping of wastewater from a sanitary or combined sewer system through closed pumps and pipes | | D | Entire space or room plus envelope 0.9 m (3 ft) around vents | Division 2 | NC, LC, or LFS | FE |
| 16 | | ABOVEGRADE WASTEWATER PUMPING STATION<br>Pump room physically separated with no personnel access to wet well; pumping of wastewater from a sanitary or combined sewer system through closed pumps and pipes | N/A | NR | N/A | Unclassified | NC, LC, or LFS | FE |
| 17 | a | ABOVEGRADE WASTEWATER PUMPING STATION | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | A | Entire space or room plus envelope 0.9 m (3 ft) around vents | Division 1 | NC | FE |
| | b | | | A | 1.5 m (5 ft) beyond vent plus envelope 0.46 m (18 in.) extending 0.9 m (3 ft) beyond openings (hatches or doors) | Division 2 | NC | FE |
| | c | Pump room not physically separated from wet well; pumping of wastewater from a sanitary or combined sewer system through closed pumps and pipes | | B | Entire space or room plus envelope 0.9 m (3 ft) around vents | Division 2 | NC, LC, or LFS | FE |

*(continues)*

**Δ Table 4.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D) | Materials of Construction[c] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 18 | a | ODOR-CONTROL AND VENTILATION SYSTEMS SERVING CLASSIFIED LOCATIONS | Leakage and ignition of flammable gases and vapors | D | Envelope 0.9 m (3 ft) around vents from Division 1 gas | Division 2 | NC, LC, or LFS | CGD and FAS |
| | b | | | D | Entire area if enclosed plus 1.5 m (5 ft) beyond vents from Division 1 gas plus envelope 0.9 m (3 ft) around vents from Division 2 gas | Division 2 | NC, LC, or LFS | CGD and FAS |
| | c | | | C | Areas within 0.9 m (3 ft) of leakage sources such as vents, fans, dampers, flexible connections, flanges, pressurized unwelded ductwork, and odor-control vessels | Division 2 | NC, LC, or LFS | CGD and FAS |
| | d | | | C | Areas beyond 0.9 m (3 ft) | Unclassified | NC, LC, or LFS | CGD and FAS |
| | e | | | Not enclosed, open to the atmosphere | Areas within 0.9 m (3 ft) of leakage sources such as vents, fans, dampers, flexible connections, flanges, pressurized unwelded ductwork, and odor-control vessels plus envelope 0.9 m (3 ft) around vents from Division 2 gas | Division 2 | NC, LC, LFS | FE |
| | f | | | Not enclosed, open to the atmosphere | Areas beyond 0.9 m (3 ft) | Unclassified | NC, LC, LFS | FE |
| 19 | a | MAINTENANCE HOLES | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Inside | Division 1 | In accordance with 8.3.5 | NR |
| | b | Access to sewer for personnel entry | | B | Inside | Division 2 | In accordance with 8.3.5 | NR |
| 20 | a | JUNCTION CHAMBERS | Buildup of vapors from ignitible (flammable or combustible) liquids | NNV | Inside | Division 1 | In accordance with 8.3.5 | NR |
| | b | Structure where sewers intersect | | B | Open and above grade or inside and ventilated | Division 2 | In accordance with 8.3.5 | NR |

*(continues)*

**Δ Table 4.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D) | Materials of Construction[c] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 21 | | INVERTED SIPHONS<br>Depressed section of gravity sewer | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Interior of inlet and outlet structures | Division 1 | NC | NR |
| 22 | | CATCH BASINS<br>(Curb inlet) Inlet where street water enters a storm or combined sewer | Buildup of vapors from ignitible (flammable or combustible) liquids | NNV | Enclosed space | Division 2 | In accordance with 8.3.5 | NR |
| 23 | a | RESIDENTIAL DIVERSION STRUCTURES | Buildup of vapors from ignitible (flammable or combustible) liquids | NNV | Enclosed space | Division 2 | In accordance with Chapter 8 | NR |
| | b | Enclosed structures where residential wastewater can be diverted | | B | Enclosed space | Unclassified | In accordance with Chapter 8 | NR |
| 24 | a | RESIDENTIAL BELOWGRADE OR PARTIALLY BELOWGRADE VALVE VAULT | Possible ignition of gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Enclosed space | Division 2 | In accordance with 8.3.5 | NR |
| | b | With an exposed residential wastewater surface | | B | Enclosed space | Unclassified | In accordance with 8.3.5 | NR |
| 25 | a | RESIDENTIAL CONTROL STRUCTURES | Buildup of vapors from ignitible (flammable or combustible) liquids | A | Enclosed space | Division 2 | In accordance with Chapter 8 | NR |
| | b | Enclosed structures where residential wastewater flow is regulated | | B | Enclosed space | Unclassified | In accordance with Chapter 8 | NR |
| 26 | a | RESIDENTIAL BELOWGRADE OR PARTIALLY BELOWGRADE METERING VAULT | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Enclosed space | Division 2 | In accordance with 8.3.5 | NR |
| | b | With an exposed residential wastewater surface | | B | Enclosed space | Unclassified | In accordance with 8.3.5 | NR |
| 27 | a | DIVERSION STRUCTURES | Buildup of vapors from ignitible (flammable or combustible) liquids | NNV | Enclosed space | Division 1 | In accordance with Chapter 8 | NR |
| | b | Enclosed structures where wastewater can be diverted | | B | Enclosed space | Division 2 | In accordance with Chapter 8 | NR |
| 28 | | ABOVEGRADE VALVE VAULT<br>Physically separated from the wet well; valves in vault in closed piping system | N/A | NR | N/A | Unclassified | NC, LC, or LFS | NR |

*(continues)*

**Δ Table 4.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D) | Materials of Construction[c] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 29 | a | BELOWGRADE OR PARTIALLY BELOWGRADE VALVE VAULT | Buildup of vapors from ignitible (flammable or combustible) liquids | NNV | Entire room or space plus envelope 0.9 m (3 ft) around vents | Division 2 | NC, LC, or LFS | NR |
| | b | Physically separated from the wet well and with closed piping system | | C | Enclosed space | Unclassified | NC, LC, or LFS | NR |
| 30 | a | BELOWGRADE OR PARTIALLY BELOWGRADE VALVE VAULT | Possible ignition of gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Enclosed space | Division 1 | NC | NR |
| | b | With an exposed wastewater surface | | B | Enclosed space | Division 2 | NC, LC, or LFS | NR |
| 31 | a | CONTROL STRUCTURES | Buildup of vapors from ignitible (flammable or combustible) liquids | A | Enclosed space | Division 1 | In accordance with Chapter 8 | NR |
| | b | Enclosed structures where wastewater or storm water flow is regulated | | B | Enclosed space | Division 2 | In accordance with Chapter 8 | NR |
| 32 | a | WASTEWATER HOLDING BASINS | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | A or NNV | Enclosed space plus envelope 0.9 m (3 ft) around vents | Division 1 | NC | NR |
| | b | | | A or NNV | 1.5 m (5 ft) beyond Division 1 vents plus envelope 0.46 m (18 in.) extending 0.9 m (3 ft) around openings (hatches or doors) | Division 2 | NC | NR |
| | c | Enclosed structures temporarily holding untreated or partially treated wastewater | | B | Enclosed space plus envelope 0.9 m (3 ft) around vents | Division 2 | NC, LC, or LFS | NR |
| 33 | | WASTEWATER HOLDING BASINS, LINED OR UNLINED<br>Open structures holding storm water, combined wastewater, untreated or partially treated wastewater | NR | NR | NR | NR | NR | NR |
| 34 | a | BELOWGRADE OR PARTIALLY BELOWGRADE METERING VAULT | Buildup of vapors from ignitible (flammable or combustible) liquids | NNV | Enclosed space plus envelope 0.9 m (3 ft) around vents | Division 2 | NC, LC, or LFS | NR |
| | b | Physically separated from the wet well and with closed piping system | | C | Enclosed space | Unclassified | NC, LC, or LFS | NR |
| 35 | a | BELOWGRADE OR PARTIALLY BELOWGRADE METERING VAULT | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | NNV | Enclosed space | Division 1 | NC | NR |
| | b | With an exposed wastewater surface | | B | Enclosed space | Division 2 | NC, LC, or LFS | NR |

*(continues)*

**Δ Table 4.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D) | Materials of Construction[c] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 36 | | COARSE AND FINE SCREEN FACILITIES<br>*(See "Coarse and Fine Screen Facilities" in Table 5.2.2.)* | | | | | | |

Note: The following codes are used in this table:
A: No ventilation or ventilated at less than 12 air changes per hour
B: Continuously ventilated at 12 changes per hour
C: Continuously ventilated at six air changes per hour
CGD: Combustible gas detection system
D: No ventilation or ventilated at less than six air changes per hour
FAS: Fire alarm system
FE: Portable fire extinguishers installed, located, and maintained in accordance with NFPA 10
LC: Limited-combustible material
LFS: Low flame spread index material
N/A: Not applicable
NC: Noncombustible material
*NEC*: In accordance with *NFPA 70*
NNV: Not normally ventilated
NR: No requirement

[a]The "Row" and "Line" columns are used to refer to specific figures in A.4.2 and specific requirements for each location and function.
[b]This column indicates the ventilation requirements for processes. Additional ventilation requirements are provided in Chapter 9. Ventilation signaling and alarm requirements are provided in Chapter 7.
[c]This column indicates the materials of construction for processes. Materials of construction for buildings in which these processes are housed are in accordance with the applicable building code and construction requirements provided in Chapter 8.

## Chapter 5 Liquid Stream Treatment Processes

### 5.1* General.

**5.1.1** This chapter shall establish minimum criteria for protection against fire and explosion hazards associated with liquid stream treatment processes.

**5.1.2** This chapter shall not apply to treatment systems serving individual structures or treatment systems that principally treat industrial wastes.

**5.1.3** When electrical work is performed as permitted in accordance with 130.2(A) of NFPA *70E*, a portable gas detector and an energized electrical work permit shall be required and documented in order to maintain a safe working condition.

**5.1.3.1** The atmosphere in the space shall be maintained below 10 percent of the LFL.

**5.1.4** Before hot work operations such as welding, cutting, and similar spark-producing operations begin in a location that has not been designated for such operations, a portable gas detector and a written hot work permit shall be required and documented as per 5.4.1 of NFPA 51B in order to maintain a safe working condition.

**5.1.4.1** The atmosphere in the space shall be maintained below 10 percent of the LFL.

**5.1.5** A sign that meets the requirements of ANSI/NEMA Z535.2, *Environmental and Facility Safety Signs*, shall be posted at the entrance informing of the potential hazards of a flammable atmosphere in classified locations identified in this chapter.

### 5.2* Design and Construction.

**5.2.1** The design and construction of liquid stream treatment processes associated with wastewater liquids treatment shall comply with the applicable building code and the additional requirements in Chapters 7 through 9.

**5.2.2** The design and construction of liquid stream treatment processes associated with wastewater liquids treatment shall conform to Table 5.2.2.

## Δ Table 5.2.2 Liquid Stream Treatment Processes

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location[c] | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 1 | a | DIVERSION AND CONTROL STRUCTURES Not preceded by Primary Treatment with Skimming | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | A | Enclosed — entire space | Division 1 | NC | FE, H; CGD if enclosed in building |
| | b | | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | FE, H; CGD if enclosed in a building |
| | c | | | Not enclosed, open to atmosphere | Within a 3 m (10 ft) envelope around equipment and open channel | Division 2 | NC, LC, or LFS | FE and H |
| 2 | a | COARSE AND FINE SCREEN FACILITIES<br>Removal of screenings from raw wastewater | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | A | Enclosed — entire space | Division 1 | NC | FE, H, CGD |
| | b | | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | FE, H, CGD |
| | c | | | Not enclosed, open to atmosphere | Within a 3 m (10 ft) envelope around equipment and open channel | Division 2 | NC, LC, or LFS | FE, H |
| 3 | | PUMPING STATIONS, DIVERSION STRUCTURES AND CONTROL STRUCTURES *(See Table 4.2.2.)* | | | | | | |
| 4 | a | FLOW EQUALIZATION TANKS<br>Storage of raw or partially treated wastewater | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | A | Enclosed — entire space | Division 1 | NC | FE, H; CGD if enclosed in a building |
| | b | | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | FE, H; CGD if enclosed in a building |
| | c | | | Not enclosed, open to atmosphere | Within a 3 m (10 ft) envelope around equipment and open channel[f,g] | Division 2 | NC, LC, or LFS | FE, H |
| 5 | a | GRIT REMOVAL TANKS Separation of grit from raw wastewater | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | A | Enclosed — entire space | Division 1 | NC | FE, H; CGD if enclosed in a building |
| | b | | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | FE, H; CGD if enclosed in a building |
| | c | | | Not enclosed, open to atmosphere | Within a 3 m (10 ft) envelope around equipment and open channel[f,g] | Division 2 | NC, LC, or LFS | FE, H |
| 6 | a | PREAERATION TANKS<br>Conditioning of wastewater prior to further treatment | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | A | Enclosed — entire space | Division 1 | NC | H; CGD if enclosed in a building |
| | b | | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | H; CGD if enclosed in a building |
| | c | | | Not enclosed, open to atmosphere | Within a 3 m (10 ft) envelope around equipment and open channel[f,g] | Division 2 | NC, LC, or LFS | H |

*(continues)*

**Δ Table 5.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location[c] | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 7 | a | PRIMARY SEDIMENTATION TANKS | Possible ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] | A | Enclosed — entire space | Division 1 | NC | H; CGD if enclosed in a building |
| | b | Separation of floating or settleable solids from raw wastewater | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | H; CGD if enclosed in a building |
| | c | | | Not enclosed, open to atmosphere | Interior of the tank from the minimum operating water surface to the top of the tank wall; envelope 0.46 m (18 in.) above the top of the tank and extending 0.46 m (18 in.) beyond the exterior wall; envelope 0.46 m (18 in.) above grade extending 3 m (10 ft) horizontally from the exterior tank walls | Division 2 | NC, LC, or LFS | H |
| 8 | | AERATION BASIN, POND, LAGOON, OXIDATION DITCH, AEROBIC SUSPENDED GROWTH SYSTEMS, SEQUENCING BATCH REACTORS Aerobic treatment of wastewater open to the atmosphere | N/A | NR | | Classified *(see Primary Sedimentation)* Unclassified if process is preceded by primary sedimentation | NR | H |

*(continues)*

**Δ Table 5.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location[c] | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 9 | a1 | ENCLOSED AERATION BASIN, AEROBIC OR SUSPENDED GROWTH SYSTEMS, MEMBRANE BIOLOGICAL REACTORS | Possible ignition of flammable gases or floating Class I liquids [flash point < 37.8°C (100°F)] | A (Interior of tank) | Entire enclosed space or tank of system | Division 1 | NC | NR |
| | a2 | Aerobic treatment not preceded by primary treatment with skimming | | A (Interior of tank) | Exterior of enclosed space or tank, installed in a building | Division 2 | NC, LC, or LFS | NR |
| | a3 | | | A (Interior of tank) | Exterior of enclosed space or tank, installed outdoors; envelope 0.46 m (18 in.) surrounding tank | Division 2 | NC, LC, or LFS | NR |
| | b1 | | | B (Interior of tank maintained at negative pressure) | Entire enclosed space or tank of system | Division 2 | NC, LC, or LFS | NR |
| | b2 | | | B (Interior of tank maintained at negative pressure) | Exterior of enclosed space or tank, installed in a building | Unclassified | NC, LC, or LFS | NR |
| | b3 | | | B (Interior of tank maintained at negative pressure) | Exterior of enclosed space or tank, installed outdoors | Unclassified | NC, LC, or LFS | NR |
| | c | | | Not enclosed, open to atmosphere | Interior of tank from the minimum operating water surface to the top of the tank wall; envelope 0.46 m (18 in.) above the top of the tank and extending 0.46 m (18 in.) beyond exterior wall; envelope 0.46 m (18 in.) above grade and extending 3 m (10 ft) horizontally from the exterior tank walls | Division 2 | NC, LC, or LFS | NR |
| 10 | a1 | RESIDENTIAL ENCLOSED AERATION BASIN, AEROBIC OR SUSPENDED GROWTH SYSTEMS, MEMBRANE BIOLOGICAL REACTORS | Possible ignition of flammable gases or floating Class I liquids [flash point < 37.8°C (100°F)] | A (Interior of tank) | Entire enclosed space or tank of system | Division 2 | NC | NR |
| | a2 | Aerobic treatment not preceded by primary treatment with skimming, serving one but not more than five dwellings | | A (Interior of tank) | Exterior of enclosed space or tank, installed in a building | Unclassified | NC, LC, or LFS | NR |
| | a3 | | | A (Interior of tank) | Exterior of enclosed space or tank, installed outdoors | Unclassified | NC, LC, or LFS | NR |

*(continues)*

**Δ Table 5.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location[c] | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 11 | | ENCLOSED AERATION BASIN, AEROBIC OR SUSPENDED GROWTH SYSTEMS, MEMBRANE BIOLOGICAL REACTORS<br>Aerobic treatment of wastewater preceded by primary treatment with skimming | N/A | NR | Entire enclosed space | Unclassified | NC, LC, or LFS | NR |
| 12 | | TRICKLING FILTER, BIO-TOWER, AEROBIC FIXED-FILM SYSTEMS<br>Aerobic biological treatment of wastewater | Not normally a significant hazard; however, these processes might contain materials that are combustible under certain conditions | NR | N/A | Classified *(See Primary sedimentation)* Unclassified if unit process is preceded by primary sedimentation | NR | H |
| 13 | a | ANAEROBIC TOWERS, ANAEROBIC FIXED-FILM SYSTEM | Normally produces combustible gas as treatment process by-product | N/A | Tank interior | Division 1 | NC | FE and H |
| | b | Anaerobic biological treatment if sealed from atmosphere | | N/A | 3 m (10 ft) envelope around tank | Division 2 | NC, LC, or LFS | FE and H |
| 14 | a | GAS-HANDLING SYSTEMS FOR LIQUID TREATMENT PROCESSES | Combustible gas, often under pressure | A | Enclosed — entire space | Division 1 | NC | FE and H |
| | b | | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | FE and H |
| | c | | | Not enclosed, open to atmosphere | Within a 3 m (10 ft) envelope around equipment[f] | Division 2 | NC, LC, or LFS | FE and H |
| 15 | | OXYGEN AERATION TANKS<br>Tanks for aerobic treatment of wastewater using high-purity oxygen rather than air | Ignition of flammable gases and floating Class I liquids [flash point < 37.8°C (100°F)] in an oxygen-enriched environment | N/A | Enclosed space | Division 2 (If unit process is not preceded by primary sedimentation, see Primary sedimentation Tanks in Table 5.2.2 for classification.) | Any equipment or material within the reactor space should be safe for exposure to volatile in an oxygen-enriched atmosphere | Special provision for LFL monitoring and automatic isolation of equipment and oxygen supply |
| 16 | | INTERMEDIATE, SECONDARY, OR TERTIARY SEDIMENTATION TANKS<br>Separate floating and settleable solids from wastewater at various treatment stages | N/A | NR | N/A | Classified *(See Primary sedimentation)* Unclassified if unit process is preceded by primary sedimentation | NR | H |
| 17 | | FLASH MIXER OR FLOCCULATION TANKS<br>Tanks for mixing various treatment chemicals with wastewater | N/A | NR | N/A | Classified *(See Primary sedimentation)* Unclassified if unit process is preceded by primary sedimentation | NR | H |
| 18 | | NITRIFICATION AND DENITRIFICATION TANKS<br>Tertiary treatment of wastewater to reduce or remove nitrogen | N/A | NR | N/A | Classified *(See Primary sedimentation)* Unclassified if unit process is preceded by primary sedimentation | NR | H |

*(continues)*

**Δ Table 5.2.2** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location[c] | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 19 | | BREAKPOINT CHLORINATION TANKS AND CHLORINE CONTACT TANKS<br>Application of chlorine in aqueous solution to wastewater | N/A | NR | N/A | Unclassified | NR (These unit processes use corrosive chemicals that require the use of specific materials of construction. Special consideration should be given to these materials of construction.) | H |
| 20 | | AMMONIA STRIPPING TOWERS | *(See Trickling filter in Table 5.2.2.)* | N/A | N/A | Unclassified | NR (These unit processes use corrosive chemicals. Special consideration should be given to these materials of construction.) | H |
| 21 | | INTERMEDIATE OR FINAL PUMPING STATIONS AND OTHER UNIT PROCESSES AND STRUCTURES NOT SPECIFICALLY ADDRESSED IN THIS TABLE. Preceded by primary treatment with skimming | N/A | NR | N/A | Unclassified | NR | H |
| 22 | | GRAVITY AND PRESSURE FILTERS<br>Filtering of treated wastewater through sand or other media | N/A | NR | N/A | Unclassified | NR | H |
| 23 | | CARBON COLUMN OR TANKS<br>Vessels containing carbon for tertiary treatment of wastewater | Significant hazard from combustible carbon material | N/A | N//A | Unclassified | NR | H |
| 24 | | ON-SITE OZONE GENERATION SYSTEM AND OZONE CONTACT TANKS<br>Ozone generation and purification for disinfection of wastewater | Similar to oxygen generation with addition of being highly corrosive *(See Table D.1.1)* | N/A | N/A | Not covered in this standard | NR | NR |
| 25 | | BACKWASH WATER AND WASTE BACKWASH WATER HOLDING TANKS<br>Tanks for temporary storage of backwash water | N/A | N/A | N/A | Unclassified | NR | H |
| 26 | | ULTRAVIOLET DISINFECTION UNIT<br>Disinfection of wastewater effluent by ultraviolet radiation | N/A | NR | N/A | Unclassified | NR | H |

*(continues)*

**Δ Table 5.2.2** ***Continued***

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b] | Extent of Classified Location[c] | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 27 | | EFFLUENT STRUCTURES<br>Various structures conveying treated wastewater away from treatment processes | N/A | NR | N/A | Unclassified | NR | H |
| 28 | | ODOR-CONTROL AND VENTILATION SYSTEMS SERVING CLASSIFIED LOCATIONS<br>*(See Table 4.2.2)* | | | | | | |

Note: The following codes are used in this table:
A: No ventilation or ventilated at less than 12 air changes per hour
B: Continuously ventilated at 12 air changes per hour in accordance with Chapter 9
C: Continuously ventilated at six air changes per hour in accordance with Chapter 9
CGD: Combustible gas detection system
D: No ventilation or ventilated at less than six air changes per hour.
FE: Portable fire extinguishers installed, located, and maintained in accordance with NFPA 10
H: Hydrant protection in accordance with 7.2.6
LC: Limited-combustible material
LFS: Low flame spread index material
N/A: Not applicable
NC: Noncombustible material
*NEC*: In accordance with *NFPA 70*
NR: No requirement

[a]The "Row" and "Line" columns are used to refer to specific figures in A.5.2 and specific requirements for each location and function.
[b]This column indicates the ventilation requirements for processes. Additional ventilation requirements are provided in Chapter 9. Ventilation signaling and alarm requirements are provided in Chapter 7.
[c]Open channels and open structures upstream from the unit processes are classified the same as the downstream processes they supply.
[d]These unit processes use corrosive chemicals that can have a deteriorating effect on conductors and equipment. Electrical equipment should be identified for use in the operating environment.
[e]This column indicates the materials of construction for processes. Materials of construction for buildings in which these processes are housed are in accordance with the applicable building code and construction requirements provided in Chapter 8.
[f]The area beyond the envelope is unclassified.
[g]Where liquid turbulence is not induced by aeration or other factors, the following criteria apply: (1) interior of the tank from the minimum operating water surface to the top of the tank wall; (2) envelope 0.46 m (18 in.) above the top of the tank and extending 0.46 m (18 in.) beyond the exterior wall; (3) envelope 0.46 m (18 in.) above grade extending 3 m (10 ft) horizontally from the exterior tank walls.

## Chapter 6 Solids Treatment Processes

### 6.1* General.

**6.1.1** This chapter shall establish minimum criteria for protection against fire and explosion hazards associated with solids treatment processes.

**6.1.2** This chapter shall not apply to the treatment of solids from industrial waste treatment processes.

**6.1.3** When electrical work is performed as permitted in accordance with 130.2(A) of NFPA *70E*, a portable gas detector and an energized electrical work permit shall be required and documented in order to maintain a safe working condition.

**6.1.3.1** The atmosphere in the space shall be maintained below 10 percent of the LFL.

**6.1.4** Before hot work operations such as welding, cutting, and similar spark-producing operations begin in a location that has not been designated for such operations, a portable gas detector and a written hot work permit shall be required and documented as per 5.4.1 of NFPA 51B in order to maintain a safe working condition.

**6.1.4.1** The atmosphere in the space shall be maintained below 10 percent of the LFL.

**6.1.5** A sign that meets the requirements of ANSI/NEMA Z535.2, *Environmental and Facility Safety Signs*, shall be posted at the entrance informing of the potential hazards of a flammable atmosphere in classified locations identified in this chapter.

### 6.2* Design and Construction.

**6.2.1** The design and construction of buildings and structures containing solids treatment processes associated with wastewater solids treatment shall comply with the applicable building code and the additional requirements of Chapters 7 through 9.

**6.2.2** The design and construction of solids treatment processes associated with wastewater solids treatment shall conform to Table 6.2.2(a) and Table 6.2.2(b).

**Δ Table 6.2.2(a) Solids Treatment Processes**

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b,c,d] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 1 | | COARSE AND FINE SCREENINGS-HANDLING BUILDINGS<br>Storage, conveying, or dewatering of screenings (no exposed flow of wastewater through building or area) | N/A | NR | N/A | Unclassified | NC, LC, or LFS | H, FE, and FAS |
| 2 | | GRIT-HANDLING BUILDING<br>Storage, conveying, and dewatering of heavy small screenings and grit (no exposed flow of wastewater through building or area) | N/A | NR | N/A | Unclassified | NC, LC, or LFS | H, FE, and FAS |
| 3 | a | SCUM-HANDLING BUILDING OR AREA | Possible grease or Class I liquids [flash point < 37.8°C (100°F)] carryover | A | Enclosed space | Division 2 | NC, LC, or LFS | H and FE; CGD if enclosed in building |
| | b | Holding, dewatering, or storage | | B | Enclosed space | Unclassified | NC, LC, or LFS | H and FE; CGD if enclosed in building |
| | c | | | Not enclosed, open to atmosphere | N/A | Unclassified | NC, LC, or LFS | H and FE |

*(continues)*

**Δ Table 6.2.2(a)** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b,c,d] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 4 | a | SCUM PITS | Buildup of vapors from ignitible (flammable or combustible) liquids | A | Enclosed — entire space | Division 1 | NC | H and FE; CGD if enclosed in building |
| | b | | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | H and FE; CGD if enclosed in building |
| | c | | | Not enclosed, open to atmosphere | Within a 3 m (10 ft) envelope around equipment and open channel[c] | Division 2 | NC, LC, or LFS | H and FE |
| | d | | | NR | N/A | Unclassified if process is preceded by primary treatment with skimming | NC, LC, or LFS | H and FE |
| 5 | a | SCUM-PUMPING AREAS | Buildup of vapors from ignitible (flammable or combustible) liquids | A | Enclosed — entire space | Division 1 | NC | H and FE; CGD if enclosed in building |
| | b | Pumping of scum, wet side of pumping station | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | H and FE; CGD if enclosed in building |
| | c | | | Not enclosed, open to atmosphere | Within a 3 m (10 ft) envelope around equipment and open channel[c] | Division 2 | NC, LC, or LFS | H and FE |
| 6 | a | SCUM-PUMPING AREAS | Buildup of vapors from ignitible (flammable and combustible) liquids | D | Enclosed space | Division 2 | NC, LC, or LFS | H and FE |
| | b | Pumping of scum, dry side of pumping station | | C | Enclosed space | Unclassified | NC, LC, or LFS | H and FE |
| | c | | | Not enclosed, open to atmosphere | N/A | Unclassified | NC, LC, or LFS | H and FE |
| 7 | | SCUM INCINERATORS[e,f] Elimination of scum through burning | Firebox explosion from possible carryover of flammable scum | NR | Incinerator area if separated from scum storage | Unclassified | NC, LC, or LFS | FAS and FSS (if indoors), H, and FE |

*(continues)*

**Δ Table 6.2.2(a)** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b,c,d] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 8 | a | SLUDGE THICKENER Sludge concentration and removal, gravity, or dissolved air flotation | Possible generation of methane from sludge; carryover of floating Class I liquids [flash point < 37.8°C (100°F)] | A | Enclosed — entire space | Division 1 | NC | H and FE; CGD if enclosed in building |
| | b | | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | H and FE; CGD if enclosed in building |
| | c | | | C | Enclosed — entire space | Unclassified if process does not contain any primary sludge | NC | H and FE |
| | d | | | Not enclosed, open to atmosphere | Interior of the tank from the minimum operating sludge surface to the top of the tank wall; envelope 0.46 m (18 in) above the top of the tank and extending 0.46 m (18 in) beyond the exterior wall; envelope 0.46 m (18 in) above grade extending 3 m (10 ft) horizontally from the exterior tank walls[c] | Division 2 | NC, LC, or LFS | H and FE |
| 9 | a | SLUDGE PUMPING STATION DRY WELLS | Buildup of methane gas or flammable vapors | D | Entire dry well when physically separated from a wet well or separate structures | Division 2 | NC, LC, or LFS | H and FE |
| | b | Dry side of a sludge pumping station | | C | Entire dry well when physically separated from a wet well or separate structures | Unclassified | NC, LC, or LFS | H and FE |

*(continues)*

**Δ Table 6.2.2(a)** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b,c,d] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 10 | a | SLUDGE STORAGE WET WELLS, PITS, AND HOLDING TANKS | Possible generation of methane gas in explosive concentrations; carryover of floating Class I liquids [flash point < 37.8°C (100°F)] | A | Enclosed — entire space | Division 1 | NC | CGD, H, and FE if tank enclosed in building |
| | b | Retaining of sludge | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | CGD, H, and FE if tank enclosed in building |
| | c | | | Not enclosed, open to atmosphere | Interior of the tank from the minimum operating sludge surface to the top of the tank wall; envelope 0.46 m (18 in) above the top of the tank and extending 0.46 m (18 in) beyond the exterior wall; envelope 0.46 m (18 in) above grade extending 3 m (10 ft) horizontally from the exterior tank walls[c] | Division 2 | NC, LC, or LFS | NR |

*(continues)*

**Δ Table 6.2.2(a)** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b,c,d] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 11 | a | SLUDGE-BLENDING TANKS AND HOLDING WELLS | Possible generation of methane gas in explosive concentrations; carryover of floating Class I liquids [flash point < 37.8°C (100°F)] | A | Enclosed — entire space | Division 1 | NC | H, FE, and CGD if tank enclosed in building |
| | b | Retaining of sludge with some agitation | | B | Enclosed — entire space | Division 2 | NC, LC, or LFS | H, FE, and CGD if tank enclosed in building |
| | c | | | Not enclosed, open to atmosphere | Interior of the tank from the minimum operating sludge surface to the top of the tank wall; envelope 0.46 m (18 in) above the top of the tank and extending 0.46 m (18 in) beyond the exterior wall; envelope 0.46 m (18 in) above grade extending 3 m (10 ft) horizontally from the exterior tank walls[c] | Division 2 | NC, LC, or LFS | NR |
| 12 | a | DEWATERING BUILDINGS CONTAINING CENTRIFUGES, GRAVITY BELT THICKENERS, BELT AND VACUUM FILTERS, AND FILTER PRESSES | Accumulation of methane gas | C | Entire room | Unclassified | NC, LC, or LFS | H, FE, and FAS |
| | b | Removal of water from sludge and the conveyance of sludge cake | | D | Entire room | Division 2 | NC, LC, or LFS | H, FE, and FAS |
| 13 | a | ENCLOSED SLUDGE CAKE STORAGE | Accumulation of methane gas | C | Entire room | Unclassified | NC, LC, or LFS | H, FE, and FAS |
| | b | Storage of dewatered sludge cake and conveyance of sludge cake | | D | Entire room | Division 2 | NC, LC, or LFS | H, FE, and FAS |
| 14 | | INCINERATORS[f] AND INCINERATOR BUILDINGS<br>Conveying and burning of sludge cake | Firebox explosion | NR | N/A | Unclassified | NC, LC, or LFS | FAS and FSS (if indoors), H, and FE |

*(continues)*

**Δ Table 6.2.2(a)** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b,c,d] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 15 | | HEAT TREATMENT UNITS, LOW- OR HIGH-PRESSURE OXIDATION UNITS<br>Closed oxidation of sludge | None, other than in high-pressure systems | NR | N/A | Unclassified | NC, LC, or LFS | H and FE |
| 16 | a | ANAEROBIC DIGESTERS, BOTH FIXED ROOF AND FLOATING COVER<br>Generation of sludge gas from digesting sludge | Leakage of gas from cover, piping, emergency relief valves, and appurtenances | Not enclosed, open to atmosphere | Tank interior; areas above and around digester cover; envelope 3 m (10 ft) above the highest point of cover, when cover is at its maximum elevation, and 1.5 m (5 ft) from any wall | Division 1 | NC | H and FE |
| | b | | | Not enclosed, open to atmosphere | Envelope<br>4.6 m (15 ft) above Division 1 area over cover and<br>1.5 m (5 ft) beyond Division 1 area around tank walls | Division 2 | NC | H and FE |
| | c | | | A | For digester tanks enclosed in a building: tank interior; entire area inside building | Division 1 | NC | CGD if enclosed in building |
| | d | | | B | For digester tanks enclosed in a building: tank interior; areas above and around digester cover; envelope 3 m (10 ft) above highest point of cover, when cover is at its maximum elevation, and 1.5 m (5 ft) from any wall of digester tank | Division 1 | NC | CGD if enclosed in building |
| | e | | | B | Remaining space in enclosed area | Division 2 | NC, LC, or LFS | CGD if enclosed in building |

*(continues)*

**Δ Table 6.2.2(a)** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b,c,d] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 17 | a | ANAEROBIC DIGESTER CONTROL BUILDING | Leaking and ignition of sludge gas | A | Entire building Envelope 1.5 m (5 ft) from any vent or opening to the outside atmosphere | Division 1 | NC | H, and FE; CGC if enclosed in building |
| | b | Conveyance and/or handling, of sludge gas | | A | Envelope 1.5 m (5 ft) beyond Division 1 area openings | Division 2 | NC, LC, or LFS | H and FE |
| | c | | | B | Enclosed areas that contain gas-handling equipment Envelope 3 m (10 ft) from any vent or opening to the outside atmosphere | Division 2 | NC, LC, or LFS | H, and FE; CGD if enclosed in building |
| | d | | | C | Physically separated from gas-handling equipment | Unclassified | NC, LC, or LFS | CGD, H, and FE |
| 18 | a | DIGESTER GAS-PROCESSING AREAS | Sludge gas ignition | A | Entire room | Division 1 | NC | CGD, H, and FE |
| | b | Gas compression, handling, and processing | | B | Within 1.5 m (5 ft) of equipment | Division 1 | NC, LC, or LFS | CGD, H, and FE |
| | c | | | B | Remaining space in room | Division 2 | NC, LC, or LFS | CGD, H, and FE |
| | d | | | Not enclosed, open to the atmosphere | Within 1.5 m (5 ft) of equipment | Division 1 | NC, LC, or LFS | H and FE |
| 19 | | ANAEROBIC DIGESTER GAS STORAGE Storage of sludge gas | Gas storage piping and handling | NNV | Within a 3 m (10 ft) envelope of tanks, valves, and appurtenances | Division 1 | NC, LC, or LFS | H and FE; CGD if enclosed in building |
| 20 | a | WASTE GAS BURNERS Combusting excess gas | Gas piping and appurtenances | N/A | Within 3 m (10 ft) envelope of all fixtures, appurtenances, and housing | Division 1 | NC | NR |
| | b | | | | Envelope 4.6 m (15 ft) above Division 1 envelope and 1.5 m (5 ft) on all sides | Division 2 | NC | NR |
| | c | | | | Envelope 1 m (3 ft) up, to the side, and below all pilot fuel piping, fixtures, appurtenances, and housing | Division 2 | NC | NR |

*(continues)*

**Δ Table 6.2.2(a)** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b,c,d] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 21 | | CHLORINE OXIDATION UNITS<br>Chlorine reaction with sludge | Chlorine is a very strong oxidizing agent | NR | N/A | Unclassified | NR (These unit processes use corrosive chemicals that require the use of specific materials of construction. Special consideration should be given to such materials of construction.) | H and FE |
| 22 | a | UNDERGROUND (PIPING) TUNNELS CONTAINING NATURAL GAS PIPING OR SLUDGE GAS PIPING | Ignition of natural gas or sludge gases | D | Within 3 m (10 ft) of valves and appurtenances | Division 1 | NC, LC, or LFS | CGD, FAS, and FE |
| | b | Transmission of gas, sludge, water, air, and steam via piping; also might contain power cable and conduit | | D | Entire tunnel | Division 2 | NC, LC, or LFS | CGD, FAS, and FE |
| | c | | | C | Areas within 3 m (10 ft) of valves, meters, gas check valves, condensate traps, and other piping appurtenances | Division 2 | NC, LC, or LFS | CGD, FAS, and FE |
| | d | | | C | Areas beyond 3 m (10 ft) | Unclassified | NC, LC, or LFS | CGD, FAS, and FE |
| 23 | | UNDERGROUND (PIPING) TUNNELS NOT CONTAINING NATURAL GAS PIPING OR SLUDGE GAS PIPING<br>Transmission of sludge, water, air, and steam piping; also might contain power cable and conduit | N/A | NR | N/A | Unclassified | NC, LC, or LFS | FAS and FE |
| 24 | a | COMPOSTING PILES | Liberation of ammonia and toxic gas (composting materials can self-ignite) | D | Enclosed area | Division 2 | NC, LC, or LFS | H, FAS, and FSS |
| | b | Aerobic sludge reduction | | C | Enclosed area | Unclassified | NC, LC, or LFS | H, FAS, and FSS |

*(continues)*

**Δ Table 6.2.2(a)** *Continued*

| Row[a] | Line[a] | Location and Function | Fire and Explosion Hazard | Ventilation[b,c,d] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class I, Group D)[d] | Materials of Construction[e] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 25 | a | IN-VESSEL COMPOSTING Aerobic sludge reduction | Liberation of ammonia and toxic gas (composting materials can self-ignite) | As required by process | If enclosed, interior of reactor vessel plus a 3 m (10 ft) envelope around reactor vessel | Division 2 | NC | H, FAS, and FSS |
| | b | | | As required by process | Areas beyond 3 m (10 ft) | Unclassified | NC | H |
| 26 | | ODOR-CONTROL AND VENTILATION SYSTEMS SERVING CLASSIFIED LOCATIONS *(See Table 4.2.2)* | | | | | | |
| 27 | | PUMPING OF DRAINAGE FROM DIGESTED SLUDGE-DEWATERING PROCESSES<br>Pumping of centrate, filtrate, leachate, drying beds, and so forth | N/A | NR | N/A | Unclassified | NC, LC, or LFS | H |

Note: The following codes are used in this table:
A: No ventilation or ventilated at less than 12 air changes per hour
B: Continuously ventilated at 12 air changes per hour in accordance with Chapter 9
C: Continuously ventilated at six air changes per hour in accordance with Chapter 9
CGD: Combustible gas detection system
D: No ventilation or ventilated at less than six air changes per hour
FAS: Fire alarm system
FE: Portable fire extinguishers installed, located, and maintained in accordance with NFPA 10
FSS: Fire suppression system (e.g., automatic sprinkler, water spray, foam, gaseous, or dry chemical)
H: Hydrant protection in accordance with 7.2.6
LC: Limited-combustible material
LFS: Low flame spread index material
N/A: Not applicable
NC: Noncombustible material
*NEC*: In accordance with *NFPA 70*
NNV: Not normally ventilated
NR: No requirement

[a]The "Row" and "Line" columns are used to refer to specific figures in A.6.2 and specific requirements for each location and function.
[b]This column indicates the ventilation requirements for processes. Additional ventilation requirements are provided in Chapter 9. Ventilation signaling and alarm requirements are provided in Chapter 7.
[c]The area beyond the envelope is unclassified.
[d]These unit processes use corrosive chemicals that can have a deteriorating effect on conductors and equipment. Electrical equipment should be identified for use in the operating environment.
[e]This column indicates the materials of construction for processes. Materials of construction for buildings in which these processes are housed are in accordance with the applicable building code and construction requirements provided in Chapter 8.
[f]See NFPA 54, NFPA 82, and NFPA 85.

**Δ Table 6.2.2(b) Solids Treatment Processes — Sludge Drying**

| Row | Line | Location and Function | Fire and Explosion Hazard | Ventilation[a,b] | Extent of Classified Location | *NEC* Hazardous Location Classification (All Class II, Group G)[c] | Materials of Construction[d] | Fire Protection Measures |
|---|---|---|---|---|---|---|---|---|
| 1 | a | SLUDGE-DRYING PROCESSES[e] | Potential for ignition of dust | NR | If exposed to combustible particulate solids, entire room[f] | Division 1 | NC (Construction in accordance with NFPA 30, NFPA 68, NFPA 69, NFPA 499, and NFPA 654) | H, FAS, and FSS *(See NFPA 30, NFPA 61, NFPA 69, NFPA 85, NFPA 499, and NFPA 654)* |
| | b | | | NR | Areas within equipment processing combustible particulate solids | Division 1 | NC (Construction in accordance with NFPA 30, NFPA 68, NFPA 69, NFPA 499, and NFPA 654) | H, FAS, and FSS *(See NFPA 30, NFPA 61, NFPA 69, NFPA 85, NFPA 499, and NFPA 654)* |
| | c | | | NR | Areas within 3 m (10 ft) of equipment processing combustible particulate solids | Division 2 | NC (Construction in accordance with NFPA 30, NFPA 68, NFPA 69, NFPA 499, and NFPA 654) | H, FAS, and FSS *(See NFPA 30, NFPA 61, NFPA 69, NFPA 85, NFPA 499, and NFPA 654)* |
| | d | | | NR | Areas beyond 3 m (10 ft) of equipment processing combustible particulate solids | Unclassified | NC (Construction in accordance with NFPA 30, NFPA 68, NFPA 69, NFPA 499, and NFPA 654) | H, FAS, and FSS *(See NFPA 30, NFPA 61, NFPA 69, NFPA 85, NFPA 499, and NFPA 654)* |
| 2 | a | DRIED SLUDGE STORAGE AREAS, IF ENCLOSED | Potential for ignition of dust | NR | If exposed to dried sludge, entire room[e] | Division 1 | NC (Construction in accordance with NFPA 68 and NFPA 69, NFPA 499, and NFPA 654) | H, FAS *(See NFPA 61, NFPA 69, NFPA 497, and NFPA 654)* |
| | b | | | NR | Areas within tanks storing dried sludge | Division 1 | NC (Construction in accordance with NFPA 68, NFPA 69, NFPA 499, and NFPA 654) | H and FAS *(See NFPA 61, NFPA 69, NFPA 497, and NFPA 654)* |
| | c | | | NR | Areas within 3 m (10 ft) of tanks storing dried sludge | Division 2 | NC (Construction in accordance with NFPA 68, NFPA 69, NFPA 499, and NFPA 654) | H and FAS *(See NFPA 61, NFPA 69, NFPA 497, and NFPA 654)* |
| | d | | | NR | Areas beyond 3 m (10 ft) of tanks storing dried sludge | Unclassified | NC (Construction in accordance with NFPA 68, NFPA 69, NFPA 499, and NFPA 654) | H and FAS *(See NFPA 61, NFPA 69, NFPA 497, and NFPA 654)* |

Note: The following codes are used in this table:
FAS: Fire alarm system
FSS: Fire suppression system (e.g., automatic sprinkler, water spray, foam, gaseous, or dry chemical)
H: Hydrant protection in accordance with 7.2.6
NC: Noncombustible material
*NEC*: In accordance with *NFPA 70*
NR: No requirement

[a]This column indicates the ventilation requirements for processes. Additional ventilation requirements are provided in Chapter 9. Ventilation signaling and alarm requirements are provided in Chapter 7.
[b]For sludge-drying processes that use ignitible (flammable or combustible) liquids, ventilate in accordance with NFPA 30.
[c]Or if acceptable to the authority having jurisdiction with classification in NFPA 499.
[d]This column indicates the materials of construction for processes. Materials of construction for buildings in which these processes are housed are in accordance with the applicable building code and construction requirements provided in Chapter 8.
[e]See NFPA 54, NFPA 85, NFPA 499, and NFPA 654. For sludge-drying processes that use ignitible (flammable or combustible) liquids, see NFPA 30.
[f]The area beyond the envelope is unclassified.

## Chapter 7 Fire and Explosion Prevention and Protection

**7.1* Scope.** This chapter shall establish minimum requirements for overall protection against fire and explosion hazards in wastewater facilities and associated collection systems.

**7.1.1** This standard shall apply to the flammability properties of a particular substance, process, or area within wastewater and collection facilities.

**7.1.2** Chapter 10 shall be referenced for additional requirements to protect against fire and safety hazards.

### 7.2 Fire Protection Measures.

#### 7.2.1 General.

**7.2.1.1** Collection systems, liquid stream treatment processes, and solids-handling processes shall be provided with fire protection for the fire hazards, as described in Table 4.2.2, Table 5.2.2, Table 6.2.2(a), and Table 6.2.2(b).

**7.2.1.2** Enclosed spaces classified as explosion hazard locations under this document shall be physically separated from all unclassified enclosures.

**7.2.1.3** In addition to the fire protection specified in Chapter 8, buildings, structures, and process elements, under some conditions, shall be provided with automatic-extinguishing systems in accordance with this chapter.

#### 7.2.2 Automatic Sprinkler Systems.

**7.2.2.1** Automatic sprinkler systems required by this standard shall conform to NFPA 13 and shall be approved by the authority having jurisdiction.

**7.2.2.2** Other automatic-extinguishing systems shall be permitted in certain areas of the wastewater treatment plant, such as the following:

(1) Chemical storage
(2) Underground tunnels or structures
(3) Areas where electrical hazard is a principal concern
(4) Areas where water damage would seriously impair the integrity of the treatment plant

Δ **7.2.3 Other Automatic-Extinguishing Systems.** Where required or used in place of automatic sprinkler systems, special-hazard-extinguishing systems and nonwater automatic-extinguishing systems shall be designed, installed, and maintained in accordance with the following standards, as applicable:

(1) NFPA 11
(2) NFPA 12
(3) NFPA 12A
(4) NFPA 15
(5) NFPA 17
(6) NFPA 770
(7) NFPA 2001

*N* **7.2.4 Water-Based Fire Protection Systems.**

*N* **7.2.4.1** Water-based fire protection systems shall include all of the following:

(1) Fire sprinkler systems
(2) Standpipe and hose systems
(3) Water spray fixed systems
(4) Foam-water sprinkler systems
(5) Water supplies that are part of water-based fire protection systems, such as the following:
    (a) Private fire service mains and appurtenances
    (b) Fire pumps and water storage tanks
    (c) Valves that control system flow

*N* **7.2.4.2** All water-based fire protection systems shall be installed in accordance with the manufacturers' specifications and the NFPA standards referenced throughout this document as summarized in Chapter 2.

*N* **7.2.4.3** All water-based fire protection systems shall be inspected, tested, and maintained in accordance with NFPA 25.

*N* **7.2.5 Other Fire Protection Systems.**

*N* **7.2.5.1** All other fire protection systems shall be installed in accordance with the manufacturers' specifications and the NFPA standards referenced throughout this document as summarized in Chapter 2.

*N* **7.2.5.2*** All other fire protection systems shall be inspected, tested, and maintained in accordance with the NFPA standards as referenced in Chapter 2.

#### 7.2.6 Water Supplies, Standpipes, Hose Systems, and Hydrants.

**7.2.6.1** Water supplies shall be capable of delivering the total demand of sprinklers, hose streams, and foam systems.

**7.2.6.1.1** In areas where there is no public water supply or where the supply is not capable of meeting the total demand required, treatment plant effluent shall be permitted for fire protection use.

**7.2.6.1.2** The requirements of the public health authority having jurisdiction shall be determined and followed.

**7.2.6.2** Water supplies and hydrants, required by Chapters 5 and 6, shall be installed in accordance with the following standards, as applicable:

(1) NFPA 1
(2) NFPA 22
(3) NFPA 24
(4) NFPA 1142

**7.2.6.3** Standpipes and hose systems shall be installed and inspected in accordance with NFPA 1 and NFPA 14.

**7.2.6.4** Where fire pumps are used as a separate and sole source of supply, the system shall provide capacity to meet simultaneous fire water flow requirements for both manual and automatic fire suppression systems and the following shall apply:

(1) A standby power supply shall be provided.
(2) Pumps shall be automatic starting and manual shutdown.
(3) Pumps shall be installed in accordance with NFPA 20.

#### 7.2.7 Portable Fire Extinguishers.

**7.2.7.1** Portable fire extinguishers shall be installed, located, and maintained in accordance with Chapters 4, 5, and 6 of this standard and NFPA 10.

**7.2.7.2** The requirement for portable fire extinguishers shall be permitted to be waived where areas are not commonly occupied and the approval of the authority having jurisdiction has been obtained.

**N 7.3 Detection Systems.**

**N 7.3.1** All detection systems shall be installed in accordance with manufacturers' specifications and *NFPA 72*.

**N 7.3.2** All detections systems shall be inspected, tested, and maintained in accordance with *NFPA 72*.

**N 7.4* Other Fire Protection System Equipment.**

**N 7.4.1** Other fire protection system equipment that is not addressed by an NFPA standard as referenced in Chapter 2 shall be installed in accordance with manufacturers' specifications.

**N 7.4.2** Other fire protection system equipment that is not addressed by an NFPA standard as referenced in Chapter 2 shall be inspected, tested, and maintained in accordance with the manufacturers' specifications.

**7.5 Fire Alarm Systems.**

**7.5.1** Fire alarm systems shall be provided in all spaces as identified in Chapters 4, 5, and 6 and installed and maintained in accordance with *NFPA 72*.

**7.5.2** Fire alarm systems shall include automatic initiating devices.

**7.6 Combustible Gas Detection.**

**7.6.1** Combustible gas detectors shall be located in accordance with Table 4.2.2, Table 5.2.2, and Table 6.2.2(a).

**7.6.2*** The selection of combustible gas detector types and their placement shall be determined by a qualified person.

**7.6.3*** Combustible gas detectors shall be listed and labeled for the intended application and shall be listed for the atmosphere in which it is installed.

**7.6.4** Detectors and signaling systems shall be provided with an auxiliary power supply to ensure continuous operation during any failure of normal power supply.

**7.6.5** The installation, calibration, maintenance, and testing of combustible gas detectors shall be in accordance with their listing requirements and the manufacturers' instructions.

**7.6.6*** Detectors required as fire protection measures in Chapters 4, 5, and 6 shall be set to alarm at 10 percent of the lower explosive limit (LEL) or 0.5 LEL per meter (LEL-m) in accordance with the manufacturers' calibration instructions.

**7.6.6.1** Where permitted by the authority having jurisdiction, the alarm limits shall be permitted to be set at higher than 10 percent of the LEL, also known as the lower flammable limit (LFL), or 0.5 LEL-m, where experience indicates ambient levels would produce spurious alarms.

**7.6.7** Detectors required as fire protection measures in Chapters 4, 5, and 6 shall be connected to alarm signaling systems that comply with the requirements of Section 7.8.

**7.7 Ventilation Monitoring.**

**7.7.1** All continuous ventilation systems that are used to reduce the classification of a space shall be fitted with flow detection devices that activate the signaling systems to indicate ventilation that does not meet the requirements of either Table 4.2.2, Table 5.2.2, Table 6.2.2(a), or Chapter 9.

**7.7.1.1** The flow detection devices shall monitor both the supply and exhaust fans, where a two-fan system is used.

**7.7.2** The alarm signaling systems shall comply with the requirements of Section 7.8.

**7.8 Alarm Signaling Systems.**

**7.8.1*** Occupiable areas shall have distinct visual and audible alarms at the entrance(s) to the areas and within the space.

**N 7.8.2*** Normally unoccupied building service equipment support areas that are not constantly monitored shall have an audible alarm or a dual visual warning system.

**N 7.8.3** Constantly monitored locations shall have local and remote alarms.

**7.8.4*** Local and remote alarms required in Section 7.8 shall be located to be readily heard and seen by responsible personnel.

**7.8.5** Alarm signaling system equipment shall be provided with an auxiliary power supply to ensure continuous operation during the failure of the normal power supply and shall be of sufficient duration to alert responsible personnel.

**7.8.6*** Visual and audible alarms required in Section 7.8 shall be tested each quarter at a minimum or in accordance with 7.8.7 to verify their functionality.

**7.8.7** The quarterly testing requirement shall be permitted to be reduced to semiannually where the conductors of the visual and audible notification appliances are continuously monitored for open circuits, short circuits, and ground faults.

**7.9 Laboratories.** Fire protection for laboratories shall be in accordance with NFPA 45.

**7.10 Special Fire Protection Measures.**

**7.10.1 Fire Protection During Construction.** Fire protection measures during construction at both new and existing wastewater facilities shall be provided in accordance with NFPA 241.

**7.10.2 Lightning Protection.** Lightning protection shall be provided in accordance with NFPA 780.

**7.10.3 Drainage.**

**7.10.3.1** Provisions shall be made in all fire areas of the plant for removal of all liquids for containment in the fire area without flooding of equipment and without endangering other areas.

**7.10.3.2** The provisions for drainage and any associated drainage facilities shall be sized to accommodate simultaneously all of the following:

(1) The spill of the largest single container of any ignitible (flammable or combustible) liquids in the area
(2) The maximum expected number of fire hose lines [31.5 L/sec (500 gal/min) minimum] operating for a minimum of 10 minutes
(3) The maximum design discharge of fixed fire suppression systems operating for a minimum of 10 minutes

**N 7.11* Impairments.**

**N 7.11.1** A written procedure in accordance with NFPA 25 shall be established to address impairments of all water-based fire protection systems.

**N 7.11.2** A written procedure in accordance with *NFPA 72* shall be established to address impairments of all detection systems.

**N 7.11.3** A written procedure that includes the following shall be established to address impairments to other fire protection systems and plant systems that have an impact on the level of fire hazard (e.g., dust collection systems, HVAC systems):

(1) Identification of equipment unavailable for service
(2) Identification of personnel to be notified (e.g., plant fire brigade chief, public fire department)
(3) Provision for an increase in fire surveillance as needed

**N 7.11.4** Following repairs, tests shall be conducted on all the affected systems to ensure operation.

**N 7.11.5** Following restoration, all the parties previously notified of the impairment shall be notified of the completion of repairs.

## Chapter 8 Materials of Construction

**8.1 General.** This chapter shall apply to the selection of materials of construction for buildings, structures, and process elements for protection against fire and explosion in wastewater treatment plants and associated collection systems.

**8.1.1*** Facilities shall be constructed in accordance with the applicable building code and the additional requirements in this standard.

**8.1.2** In areas where corrosive environments are present, including classified locations, the mitigation of corrosion problems in the selection and use of materials for nonstructural assemblies shall include the use of the following:

(1) Corrosion-resistant metallic or nonmetallic grating
(2) Corrosion-resistant railings, steps and stairs, conduit
(3) Corrosion-resistant electric equipment enclosures

**8.2 Materials Selection.**

**8.2.1** Materials shall be selected based on the criteria for the intended application.

**8.2.2** Selection criteria shall include specification of the following:

(1) Structural requirements
(2) Location and operating environment
(3) Fire resistance rating
(4) Flame spread index value
(5)* Smoke developed index or other smoke generation values
(6) Products of combustion
(7) Corrosion resistance

**Δ 8.2.3** For the purpose of this document, materials of construction shall be divided into the following four basic categories as defined in 8.2.3.1 through 8.2.3.4.

(1) Noncombustible
(2) Limited-combustible
(3) Low flame spread index
(4) Combustible

**8.2.3.1* Noncombustible Material.** A material that complies with any one of the following shall be considered a noncombustible material:

(1)* The material, in the form in which it is used, and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.
(2) The material is reported as passing ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C.*
(3) The material is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C.*

[**5000:**7.1.4.1.1]

**Δ 8.2.3.2* Limited-Combustible Material.** A material shall be considered a limited-combustible material where both of the following conditions, and the conditions of either 8.2.3.2.1 or 8.2.3.2.2 are met:

(1) The material does not comply with the requirements for a noncombustible material in accordance with 8.2.3.1.
(2) The material, in the form in which it is used, exhibits a potential heat value not exceeding 8141 kJ/kg (3500 Btu/lb), when tested in accordance with NFPA 259.

**N 8.2.3.2.1** The material shall have a structural base of noncombustible material with a surfacing not exceeding a thickness of 3.2 mm (⅛ in.) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials.* [**5000:**7.1.4.2.3]

**Δ 8.2.3.2.2** The material shall be composed of materials that in the form and thickness used, neither exhibit a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84 or UL 723 and are of such composition that all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or UL 723. [**5000:**7.1.4.2.4]

**8.2.3.2.3** Materials shall be considered limited-combustible materials where tested in accordance with ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, at an incident heat flux of 75 kW/m$^2$ (23,773 Btu/ft$^2$) for a 20-minute exposure, and both the following conditions are met:

(1) The peak heat release rate shall not exceed 150 kW/m$^2$ (47,546 Btu/ft$^2$) for longer than 10 seconds.
(2) The total heat released shall not exceed 8 MJ/m$^2$ (704 Btu/ft$^2$).

[**5000:**7.1.4.2.5]

**N 8.2.3.3 Low Flame Spread Index Material.** A low flame spread index material shall meet the requirements of either a Class A flame spread index not exceeding 25 and Class A smoke developed index not exceeding 450, when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*, or the requirements of 10.2.3.2 of NFPA *101*, when tested in accordance with NFPA 286.

**8.2.3.4 Combustible Material.** A material that, in the form in which it is used and under the conditions anticipated, will ignite and burn; a material that does not meet the definition of noncombustible or limited-combustible shall be considered a combustible material.

Δ **8.2.3.5** The material shall have a structural base of noncombustible material with a surfacing not exceeding a thickness of 3.2 mm (⅛ in.) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*. [**5000:**7.1.4.2.1]

**8.2.4** Materials of construction used for unit processes located in classified locations shall be selected based upon a documented fire risk assessment.

**8.2.4.1** Where conditions or applications warrant the selection of combustible materials, limited-combustible, or low flame spread index materials, the following shall be included as part of the fire risk assessment:

(1) Flame spread
(2) Smoke generation
(3) Corrosion resistance
(4) Products of combustion
(5) Impact of a fire or explosion on the structural integrity and operability
(6) Economic and environmental consequences of having the facility out of service

**8.3 Applications.**

**8.3.1 General.** Buildings and structures, including domes and covers, shall be constructed of materials in accordance with Table 4.2.2, Table 5.2.2, Table 6.2.2(a), and Table 6.2.2(b) except as indicated in 8.3.1.1 or 8.3.1.2.

**8.3.1.1** Small aboveground buildings and structures, including domes and covers, with a floor or surface area of 9.3 $m^2$ (100 $ft^2$) or less that are physically separated from other buildings or structures and that do not present a fire hazard to other buildings or structures shall be permitted to be constructed of any appropriate materials.

**8.3.1.2** Materials other than those required by Table 4.2.2, Table 5.2.2, Table 6.2.2(a), and Table 6.2.2(b) shall be permitted in buildings or structures that are fully sprinklered in accordance with NFPA 13 and approved by the AHJ.

**8.3.2* Critical Unit Processes.** Buildings and structures containing critical unit processes shall be of noncombustible materials in accordance with Table 4.2.2, Table 5.2.2, Table 6.2.2(a), and Table 6.2.2(b).

**8.3.2.1** Where structural assemblies and partitions are required in critical unit process areas for fire separation in accordance with the fire risk assessment, they shall have a minimum 3-hour fire rating.

**8.3.2.2** Nonstructural assemblies such as ventilation ducts and piping shall be constructed of noncombustible, limited-combustible, or low flame spread index materials.

**8.3.3* Essential Unit Processes.** Buildings and structures containing essential unit processes shall be constructed of materials meeting the definitions of noncombustible, limited-combustible, or low flame spread index in accordance with Table 4.2.2, Table 5.2.2, Table 6.2.2(a), and Table 6.2.2(b).

**8.3.3.1** Where structural assemblies and partitions are used in essential unit process areas for fire separation, they shall have a minimum 2-hour fire rating.

**8.3.3.2*** Nonstructural assemblies such as ventilation ducts and piping shall be constructed of noncombustible, limited-combustible, or low flame spread index materials.

**8.3.4* Combustible Gas Generation and Combustion Processes.** Buildings and structures containing other unit processes shall be constructed of materials as determined by the fire risk assessment.

**8.3.5* Sewers and Appurtenances.** Materials of construction for sewers and appurtenances such as maintenance holes, junction chambers, and catch basins shall be based on the results of a written materials risk assessment.

**8.3.6 Pumping Facilities.** Materials selected for wastewater pumping facilities shall be in accordance with Table 4.2.2, except as indicated in 8.3.6.1.

**8.3.6.1** Small aboveground pumping facilities with a floor area of 9.3 $m^2$ (100 $ft^2$) or less and physically separated from the wet well and that do not present a fire hazard to other buildings or structures shall be permitted to be constructed of any appropriate materials.

**8.3.7* Other Unit Processes.** Buildings and structures containing other unit processes shall be constructed of materials as determined by the fire risk assessment.

**8.3.7.1** Where structural assemblies and partitions are used in other unit process areas for fire separation, they shall have a minimum 1-hour fire rating.

**8.3.7.2** Nonstructural assemblies such as ventilation ducts and piping shall be constructed of materials meeting the definitions of noncombustible, limited-combustible, or low flame spread index.

**8.3.8 Air Supply and Exhaust.**

**8.3.8.1** Noncombustible, limited-combustible, or low flame spread index materials shall be used for air supply and exhaust systems.

## Chapter 9 Ventilation

**9.1 General.**

**9.1.1 Requirement Applications.**

**9.1.1.1** The minimum criteria for ventilation for protection against fire and explosion of wastewater treatment and pumping facilities shall be in accordance with Chapters 4, 5, and 6 for the designated electrical classifications.

**9.1.1.1.1** Ventilation used to obtain the lowest location electrical classification possible in accordance with *NFPA 70* and not addressed in Table 4.2.2, Table 5.2.2, Table 6.2.2(a), and Table 6.2.2(b) shall conform to those listed in Table 9.1.1.1.1.

**9.1.1.2*** Ventilation requirements in this standard are intended to minimize fire and explosion hazards and shall not apply to the protection of personnel from the effects of exposure to toxic gases, oxygen deficiency, or biological hazards.

**Δ Table 9.1.1.1.1 Minimum Ventilation Rates**

| Row | Line | Description | Ventilation Rate, Air Changes per Hour, or Velocity | | |
|---|---|---|---|---|---|
| | | | Class I, Division 1 | Class I, Division 2 | Unclassified |
| 1 | | Wet wells, screen rooms, and other enclosed spaces with wastewater exposed to the room atmosphere | <12 air changes per hour | 12 air changes per hour | — |
| 2 | | Belowgrade or partially belowgrade spaces such as dry wells, equipment rooms, tunnels, or galleries: | | | |
| | a | With equipment using or processing flammable gas | <12 air changes per hour or <22.2 m/min (74 ft/min) velocity in tunnels or galleries | 12 air changes per hour or 22.2 m/min (74 ft/min) velocity in tunnels or galleries | — |
| | b | With gas piping | — | <6 air changes per hour or <11 m/min (37 ft/min) velocity in tunnels or galleries | 6 air changes per hour or 11 m/min (37 ft/min) velocity in tunnels or galleries |
| | c | Without gas piping | NR for tunnels and galleries | <6 air changes per hour for dry wells; NR for tunnels and galleries | 6 air changes per hour for dry wells; NR for tunnels and galleries |
| 3 | | Abovegrade spaces such as equipment rooms and galleries: | | | |
| | a | With equipment using or processing flammable gas | <12 air changes per hour or <22.2 m/min (74 ft/min) velocity for galleries | 12 air changes per hour or 22.2 m/min (74 ft/min) velocity in galleries | — |
| | b | With gas piping | — | <6 air changes per hour or <11 m/min (37 ft/min) velocity in galleries | >6 air changes per hour or >11 m/min (37 ft/min) velocity in galleries |
| | c | Without gas piping | NR for galleries | NR for galleries | NR for galleries |

NR: No requirement.

**9.1.1.3** This chapter shall be limited to the ventilation of enclosed wastewater pumping and process-related areas and does not establish criteria applicable to spaces devoted to administrative areas, laboratories, or other ancillary spaces.

**CAUTION:** Because of the unpredictable nature of materials and events encountered in the operation of wastewater systems, the ventilation criteria established in this standard might not be adequate for protection against all hazards that might be encountered.

**9.1.1.4** This chapter shall not apply to at-grade or abovegrade unroofed structures less than 0.6 m (2 ft) deep or 0.6 m (2 ft) to the in-service waterline or to at-grade or abovegrade roofed structures where the following applies:

(1) The roof is at least 3 m (10 ft) above surrounding finished grade.
(2) The structure is open on at least three sides.

**9.2 Installation.**

**9.2.1*** Ventilation systems serving spaces governed by this standard shall be designed in accordance with NFPA 91.

**9.2.2** NFPA 91 shall not apply to the design of ventilation systems where superseded by a more restrictive provision of this standard.

**9.2.3** Ventilation systems serving hazardous locations classified under the provisions of Article 500 of *NFPA 70* shall incorporate fans fabricated in accordance with Air Moving and Control Association (AMCA) Type A or Type B spark-resistant construction.

**9.2.4** All mechanically ventilated spaces shall be served by both supply and exhaust fans, unless otherwise permitted by the following:

(1) For covered process facilities that are not routinely entered by personnel and where mechanically ventilated, the space shall be permitted to be ventilated by exhaust

fans only, and the induced supply (outside) air shall meet the ventilation rate specified in the applicable chapter when determining the location classification.

(2) Small aboveground buildings and structures, including domes and covers, with a floor or surface of 9.3 $m^2$ (100 $ft^2$) or less that are physically separated from other buildings or structures and do not present a fire hazard to other buildings or structures shall be permitted to be ventilated by a supply fan only.

**9.2.5** Ventilation systems serving unclassified locations adjacent to classified locations shall maintain a minimum differential pressure relative to ambient air pressure of 25 Pa (0.1 in. water column) under all operating conditions.

**9.2.6** Ventilation systems serving classified locations shall maintain a minimum differential pressure relative to ambient air pressure of –25 Pa (–0.1 in. water column) under all operating conditions.

**9.2.7** Ventilation systems for hazardous locations that are designed to operate intermittently or only when the space is occupied shall not be permitted to be used for the purpose of reducing the electrical classification of locations. *(See Chapters 4, 5, and 6 for further information.)*

**9.2.8** Air shall be introduced into and exhausted from hazardous locations specified in 9.2.7 in a manner that will encourage scavenging of all portions of the spaces to prevent short-circuiting and to promote the effective removal of both heavier- and lighter-than-air gases and vapors.

**9.2.9** Ventilation systems shall not transfer air between unclassified interior spaces and classified interior spaces except where an airlock that meets the requirements of Section 9.4 is installed.

**9.2.10** Ventilation systems serving areas governed by this standard shall receive power from electrical equipment that receives power from a primary power source and that also has the means to accept power from alternate power sources.

**9.2.10.1** Minimum requirements for the means to accept the alternate source of power shall include connectors that are designed to connect to devices such as standby generators, portable generators, uninterruptible power supplies, and so forth.

**9.2.10.2** Automatic or manual switching to a permanent alternate source of power shall also be permitted.

**9.2.10.3** Power failure of the primary source shall be alarmed.

*N* **9.2.11** Separate smoke ventilation systems designed and installed in accordance with NFPA 92 or NFPA 204 shall be used where applicable, unless otherwise permitted by the following:

(1) Smoke venting shall be permitted to be integrated into installed ventilation systems using automatic or manually positioned dampers and motor speed control in accordance with NFPA 91, NFPA 92, and NFPA 204.

(2) Smoke venting also shall be permitted to be accomplished using listed portable smoke ejectors.

**9.3 Ventilation Criteria.**

**9.3.1** Ventilation rates shall be based on air changes per hour and shall be calculated on the basis of the maximum aggregate volume, under normal operating conditions, of the space to be ventilated.

**9.3.1.1** Air changes per hour shall be based on 100 percent outside supply air, which shall be exhausted.

**9.3.2** Ventilation rates required by this standard shall be permitted to be reduced when all of the following criteria are met:

(1) The low ventilation rate is not less than 50 percent of that specified in Table 9.1.1.1.1.

(2) The low ventilation rate is in operation only when the outdoor ambient air temperature is 10°C (50°F) or less.

(3) The high ventilation rate is not less than that specified in Table 9.1.1.1.1.

(4) The high ventilation rate is in operation whenever the outdoor ambient air temperature is above 10°C (50°F), whenever the ventilated space is occupied, or whenever the ventilation is activated by approved combustible gas detectors set to function at 10 percent of the lower flammable limit (LFL) or 0.5 LEL per meter (LEL-m).

(5) The ventilation differential pressurization required in 9.2.5 and 9.2.6 is maintained.

**9.4* Airlocks.** Airlocks shall be permitted to meet the requirements of a physical separation between two spaces when all of the following criteria are met:

(1) Within an airlock space, provisions shall be made to ensure the completed installation includes the following:
   (a) Positive-pressure ventilation system that maintains a minimum of 25 Pa (0.1 in. water column) pressure relative to the higher classified location
   (b) Pressurization system receives power in accordance with 9.2.10
   (c) Combustible gas detection installed in accordance with Section 7.6
   (d) Alarm signaling system in accordance with Section 7.8 to indicate any of the following conditions:
      i. Any airlock door open for longer than 20 seconds
      ii. Pressurization system is not operating as required in 9.4(1)(a)
      iii. Combustible gas concentrations greater than 10 percent of the lower flammable limit (LFL)
   (e) Any electrical equipment installed in accordance with *NFPA 70* for the more restrictive hazardous location adjacent to the airlock

(2) Within an airlock space from a Class I, Division 1 location to an unclassified location, provisions shall be made to ensure the completed installation includes the following:
   (a) If combustible gas concentrations are greater than 10 percent of the LFL, and the pressurization fan is not functioning or any door is open longer than 20 seconds, an alarm is sent and one of the following occurs:
      i. An additional six air changes per hour of ventilation in the unclassified location is provided.
      ii. All electrical equipment in the unclassified location is de-energized via a shunt trip.
   (b) Install door interlock system with the following features:
      i. All doors are normally closed and unlocked.

ii. Opening any door causes other doors to lock until the opened door returns to the closed position.
iii. An emergency release pull station located inside the airlock space allows for door interlock system override.

## Chapter 10 Administrative Controls

**10.1 General.** This chapter shall establish the procedures and controls necessary for the execution of the fire prevention and fire protection activities and practices for wastewater treatment and collection facilities.

**10.2 Management Policy and Direction.**

**10.2.1*** Management shall establish a policy and institute a fire prevention and protection program at each facility.

**10.2.2** Combustible materials shall not be stored in areas used for the storage of toxic or reactive chemicals.

**10.3* Fire and Explosion Risk Assessment.** A fire and explosion risk assessment (FERA) shall be performed and documented to integrate the fire prevention and fire protection requirements described in this document.

*N* **10.3.1** A FERA shall be required for new construction or when process technology is changed from the original design.

*N* **10.3.2** The following shall be included as part of the FERA process:

(1) Facility management shall consult with employees, representatives, and affected contractors on the development process intended for the FERA methodology.
(2) The FERA shall be performed by a team with expertise in engineering, constructability, and process operations.
(3) The team shall include at least one employee who has experience and knowledge specific to the process being evaluated.
(4) One member of the team shall be knowledgeable in the specific risk analysis methodology used for the assessment.

*N* **10.3.3** Facility management shall make the FERA results readily available in the workplace upon request and communicate the findings to affected employees, contractors, and their representatives.

*N* **10.3.4** After the completion of an initial FERA, the assessment shall be updated and revalidated every five years.

*N* **10.3.5** Facility management shall document and retain information on the resolution of FERA recommendations for a period of 5 years.

**10.4 Fire Prevention Program.** Each plant shall establish a fire prevention program that includes all of the following items:

(1) Fire safety information for all employees and contractors that includes, as a minimum, the following:
  (a) Familiarization with fire protection equipment and procedures
  (b) Plant emergency alarms and procedures
  (c) Procedures for reporting a fire
(2) Documented plant inspections that are completed at least annually, including provisions for handling remedial actions to correct conditions that increase fire hazards
(3) Description of the general housekeeping procedures and the control of transient combustibles, including control of such materials stored in areas containing toxic or reactive chemicals
(4) Control of ignitible (flammable and combustible) liquids and gases in accordance with NFPA 30 and NFPA 54
(5) Control of ignition sources that include smoking, grinding, welding, and cutting in accordance with NFPA 51B
(6) Fire prevention surveillance in accordance with NFPA 601
(7)* Fire report, including an investigation and a statement on the corrective action to be taken
(8) Planning documents and training conducted in accordance with NFPA 56 for flammable gas piping repairs, cleaning, purging and planned releases of gases

**10.5 Emergency Action Plan.** A written emergency action plan shall be developed that includes the following:

(1) Response to any alarms required by this standard
(2) Notification of personnel identified in the plan
(3) Evacuation from the area of employees not directly involved in the emergency response activities
(4) Coordination with security forces or other designated personnel to admit the public fire department and to control traffic and personnel
(5) Fire extinguishment activities
(6) Operators' duties during emergencies in critical areas
(7) Approved breathing apparatus to be provided in critical areas

**10.6* Fire Brigades.**

**10.6.1*** If a fire brigade is provided, written procedures shall identify its purpose, organizational structure, equipment requirements including PPE, training, number of members, and the functions they will perform during a response.

**10.6.2** Arrangements shall be made to allow rapid entry into the plant by the municipal fire department, police department, or other authorized personnel in the case of fire or other emergency.

**10.6.3** Plant emergency organizations, where provided, shall be instructed and trained in accordance with NFPA 600.

**10.7* Polychlorinated Biphenyls.** If polychlorinated biphenyls (PCBs) are contained within the wastewater treatment plant, the owner and the local fire officials shall prepare a contingency plan to protect the plant and the collection system from possible contamination in the event that the PCBs or combustion products are leaked or washed into the drains during a fire.

Δ **10.8 Fire and Explosion Prevention.** The principal control procedures used to minimize potential fire and explosion incidents at wastewater treatment plants shall include the following:

(1)* Ventilation
(2)* Education
(3) Risk management and property conservation programs
(4) Procedures for permitting hot work
(5)* Selection of materials of construction
(6) Selection of equipment
(7) Storage, handling, and use of ignitible (flammable and combustible) liquids and gases
(8) Installation, maintenance, and use of equipment (e.g., electrical) in classified locations that present a source of ignition

**10.8.1 Control of Hazardous Source.**

**10.8.1.1** In-house training programs [e.g., plant emergency organizations (PEOs) and housekeeping or maintenance] that provide information for understanding, identifying, preventing, and handling hazardous sources and situations related to potential fire, explosion, and toxicity problems shall be established for all personnel.

**10.8.1.2*** Liaison shall be implemented and documented at least annually between the local fire department, including other authorized emergency personnel, and wastewater treatment plant safety personnel, so that mutually approved emergency procedures, including familiarity with the plant, are established.

**10.8.1.3** All storage, handling, and use of ignitible (flammable and combustible) liquids and gases shall comply with NFPA 30 and NFPA 54.

**10.8.2 Control of Ignition Sources.**

**10.8.2.1*** Personnel involved shall be educated in the conditions for and the sources of ignition of special hazards and shall be trained for the safe operation of processes.

**10.8.2.2** All personnel shall be trained to report faulty equipment, worn static bonding lines, improperly stored chemicals, and other items needing correction.

**10.8.3 Hot Work Permits.**

**10.8.3.1*** Welding, cutting, and similar spark-producing operations shall not be permitted until a written permit authorizing such work has been issued.

**10.8.3.2** The permit shall be issued by a person in authority following inspection of the area to ensure that the precautions have been taken and will be followed until the job is completed.

**10.8.3.3** When hot work is being performed in and around classified locations, the atmosphere shall be continuously monitored.

*N* **10.9 Flame-Resistant and Arc-Rated Clothing.** Personnel shall wear flame-resistant clothing that meets the requirements of NFPA 2112 when performing the following activities within classified locations:

(1) Hotwork
(2) Electrical work when arc-rated clothing is not required and where the work impacts the approval, design, level of protection, or rating of equipment

## Annex A Explanatory Material

*Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.*

**A.1.1.1** Other NFPA standards should be consulted for additional requirements relating to wastewater treatment and collection facilities.

**A.1.1.2(7)** Wastewater treatment plants can also be referred to as water resource recovery, water reclamation, or water pollution control facilities.

*N* **A.1.3.1.2** OSHA Process Safety Management (PSM) standard 29 CFR 1910.119(e) and AIChE provide references for risk assessments, process hazard analysis (PHA) processes, timing, and the development of safeguards and action plans.

**A.1.3.2.2** It is recognized that, from a personnel safety standpoint, life-threatening toxicity and biological hazards could be present while no threat of fire or explosion exists.

**A.1.3.4** Because many of the corrosion-resistant materials and coatings are combustible or limited-combustible and could represent a considerable fuel load during fire events, the design and fire risk assessment should consider any additional hazards imposed by the use of these materials.

**A.1.8** For additional information, see NFPA 497 and NFPA 499. Although some of the recommendations of these documents are not applicable to wastewater treatment facilities, both documents do provide useful information.

Δ **A.3.2.1 Approved.** The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment, or materials, the "authority having jurisdiction" may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The "authority having jurisdiction" may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

**A.3.2.2 Authority Having Jurisdiction.** The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA standards in a broad manner because jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

**A.3.2.4 Listed.** The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

**A.3.3.4 Anaerobic Digestion.** Process by-products include a gas containing methane, carbon dioxide, and small quantities of hydrogen sulfide. The digestion tank can have a fixed or floating roof system.

**A.3.3.10 Combustible Gas Detector.** All combustible gas detectors required by this standard should be permanently installed in fixed locations within the space. Portable gas monitors are required for confined space entry in accordance with other standards. Portable gas monitors are also required for hot work monitoring in accordance with Chapter 10.

**A.3.3.13 Constantly Monitored Location.** Alarms could be received by a Supervisory Control and Data Acquisition (SCADA) system, provided the SCADA system ensures responsible personnel will receive and respond to the alarm signals. Otherwise, alarms should be transmitted to a fire station, police station, or other 24-hour attended location.

**A.3.3.17.1 Gas-Handling Equipment.** Gas-handling equipment does not include equipment or devices for the utilization of the gas, such as boilers and engines.

**A.3.3.23 Flame Spread Index.** A flame spread index of 25 or less (LFS) is a flame spread index for a Class A material in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, and is generally considered a low flame spread index. The concept of heat release rate as a measure of fire hazard has grown in acceptance in recent years; therefore, codes recognize that materials tested to NFPA 286 that comply with the following criteria are suitable for use wherever a material with a flame spread index of 25 or less (and a smoke developed index of 450 or less), in accordance with ASTM E84, is required to be used:

(1) During the 40 kW (2275 Btu/min) exposure, flames should not spread to the ceiling.
(2) The flame should not spread to the outer extremity of the sample on any wall or ceiling.
(3) Flashover, as described in NFPA 286, should not occur.
(4) The peak heat release rate throughout the test should not exceed 800 kW (45,495 Btu/min).
(5) The total smoke released throughout the test should not exceed 1000 $m^2$ (10,764 $ft^2$).

**A.3.3.27 Galleries.** Galleries frequently contain gas or other hazardous material transport systems, water, wastewater, sludge piping, electrical wiring, and mechanical or electrical equipment. The concept of heat release rate as a measure of fire hazard has grown in acceptance in recent years; therefore, codes recognize that materials tested to NFPA 286 that comply with the following criteria are suitable for use wherever a material with a flame spread index of 25 or less (and a smoke developed index of 450 or less), in accordance with ASTM E84, is required to be used:

(1) During the 40 kW (2274 Btu/min) exposure, flames should not spread to the ceiling.
(2) The flame should not spread to the outer extremity of the sample on any wall or ceiling.
(3) Flashover, as described in NFPA 286, should not occur.
(4) The peak heat release rate throughout the test should not exceed 800 kW (45,495 Btu/min).
(5) The total smoke released throughout the test should not exceed 1000 $m^2$ (10,764 $ft^2$).

**A.3.3.28.2 Fuel Gas.** See NFPA 54.

**A.3.3.28.3 Sewer Gas.** The gas might contain trace quantities of methane and hydrogen sulfide, could be low in oxygen, and could be both a fire and life safety hazard.

**A.3.3.28.4 Sludge Gas.** Sludge gas has a high content of methane, varying amounts of carbon dioxide and hydrogen sulfide, and a small amount of nitrogen. It can be both a fire and life safety hazard.

*N* **A.3.3.34.3 Ignitible Liquid.** Unless otherwise specified, the term *liquid* means an ignitible liquid. The term *ignitible liquid* refers to any liquid that has a measurable closed-cup flash point. Class I liquids [FP < 37.8°C (100°F)], Class II and Class III liquids [FP ≥ 37.8°C (100°F)], and inflammable liquids are all ignitible liquids. [**30,** 2021]

*N* **A.3.3.34.4 Liquid (Physical State).** A material with a Reid vapor pressure greater than an absolute pressure of 276 kPa (40 psi) is considered to be a gas and is, therefore, not within the scope of NFPA 30. See NFPA 58. [**30,** 2021]

*N* **A.3.3.41 Normally Unoccupied Building Service Equipment Support Area.** Normally unoccupied building service support areas are often found in attics, crawl spaces, chases, and interstitial areas where the space is vacant or intended exclusively for routing ductwork, cables, conduits, piping, and similar services and is rarely accessed. In such spaces, it is often difficult or impossible to fully comply with the egress requirements of Chapter 7. Where portions of such spaces are routinely visited for storage, maintenance, testing, or inspection, that portion is excluded from this definition, but the remainder of the space might be considered a normally unoccupied building service equipment support area. Storage and fuel-fired equipment would not be expected to be permitted in these locations. Roofs are not considered to be normally unoccupied building service equipment support areas. [***101,*** 2021]

**A.3.3.47 Physically Separated.** Providing an airlock meeting the requirements of Section 9.4 is an acceptable method for achieving physical separation between spaces.

**A.3.3.48 Pumping Station.** Also called lift station.

**A.3.3.53 Sedimentation.** Sedimentation is usually accomplished by reducing the velocity of the liquid below the point at which gravity can transport the suspended material. Also called settling, it can be enhanced by chemical addition, coagulation, and flocculation.

**A.3.3.62.3 Sludge Treatment.** Sludge treatment can be accomplished by aerobic or anaerobic digestion followed by drying on sand beds, filtering and incineration, filtering and drying, or wet-air oxidation.

**A.3.3.62.4.1 Primary Treatment with Skimming.** The intent of primary treatment with skimming is to remove floatable flammable materials.

**A.3.3.68 Waste Gas Burner (flare).** This text is paraphrased from Manual of Practice (MOP) 8, *Design of Water Resource Recovery Facilities*.

**A.3.3.70.1 Dry Well.** Dry wells can contain accidental leakage of wastewater from shaft seals or occasional spills. A dry well could contain equipment such as pumps, motors, fans, wiring, controls, lights and associated wiring devices, and other accessories.

**A.3.3.70.2 Wet Well.** A wet well might or might not contain electrical equipment such as pumps, motors, fans, wiring and wiring devices, controls, lights, and other accessories.

**A.4.1** Additional information on sources of hazards, sources of ignition, and mitigation measures associated with the collection and transmission of municipal wastewater is contained in Annex D.

**A.4.2** See Figure A.4.2(a) through Figure A.4.2(f), which provide examples for Table 4.2.2.

**A.5.1** Additional information on sources of hazards, sources of ignition, and mitigation measures associated with liquid stream treatment processes is contained in Annex D.

**A.5.2** See Figure A.5.2, which provides an example for Table 5.2.2.

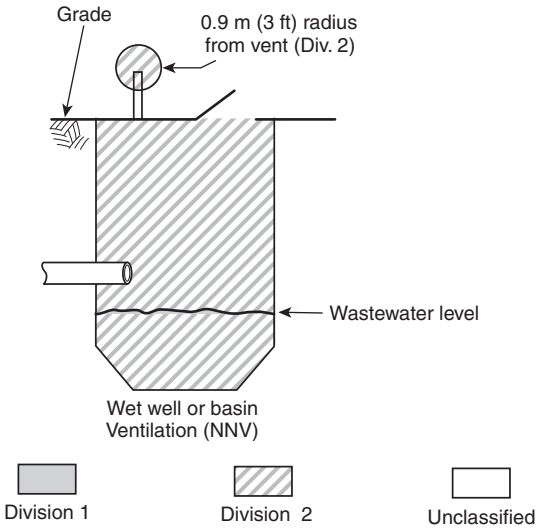
**A.6.1** Additional information on sources of hazards, sources of ignition, and mitigation measures associated with solids treatment processes is contained in Annex D.

**A.6.2** See Figure A.6.2(a) through Figure A.6.2(h), which provide examples for Table 6.2.2(a).

**A.7.1** Additional information is contained in Annex D.

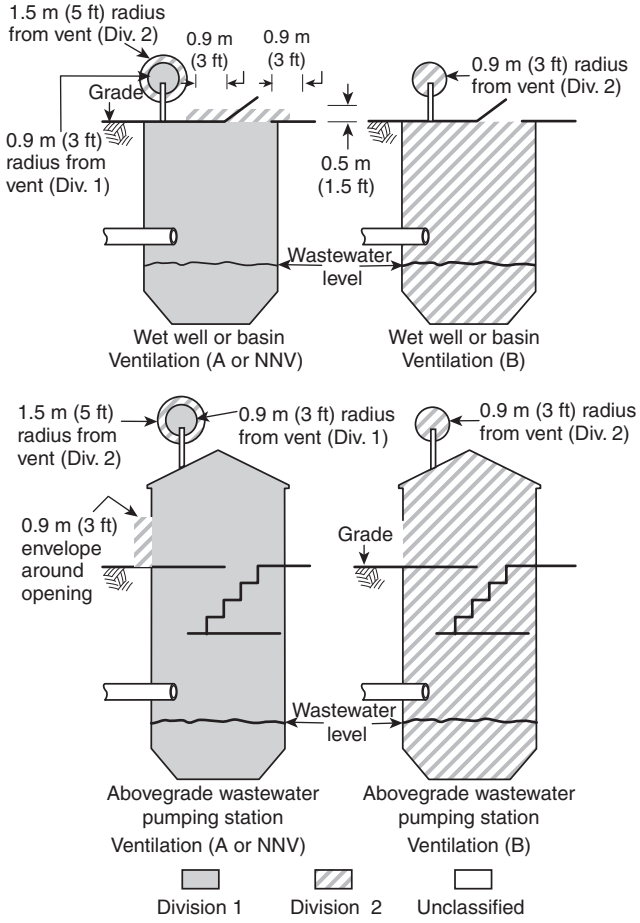
**A.7.2.5.2** Once a detection system is installed, a preventive maintenance program is essential. A detection system is only as good as the care and maintenance it receives, which is especially true in harsh environments. When installing instruments, ease of calibration and maintenance should be considered. Periodic calibration, checks, and adjustments are necessary for detection to remain accurate. If instruments are inaccessible, it is more likely that maintenance procedures will not be followed. Detectors should be located to prevent exposure to physical damage from normal activities in the area.

Consideration should be given to the scope and limitations of the listing for combustible gas detectors. For example, the UL online search tool Product iQ at www.UL.com includes information on UL certifications of combustible gas detectors.



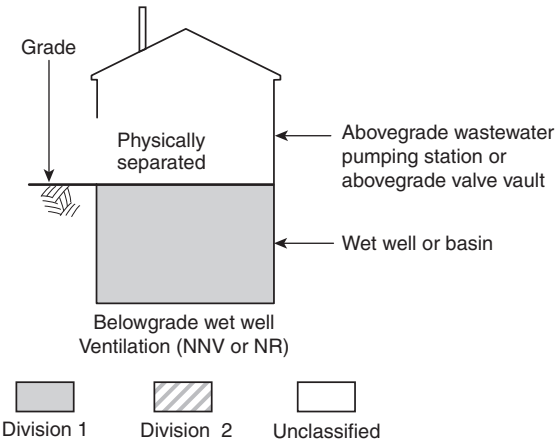

Note: Ventilation codes defined in Table 4.2.2 notes.

**FIGURE A.4.2(a) Wet Well or Basin Serving a Storm Sewer; Illustration of Table 4.2.2, Row 4.**



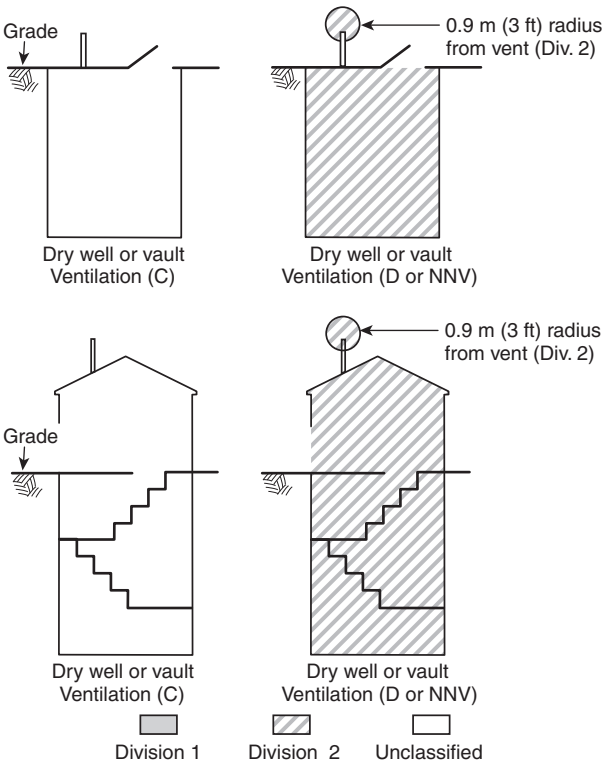

Note: Ventilation codes defined in Table 4.2.2 notes.

**Δ FIGURE A.4.2(b) Wet Well or Basin Serving Separate or Combined Sanitary Sewer; Illustration of Table 4.2.2, Rows 14 and 32 (top diagrams) and Row 17 (bottom diagrams).**



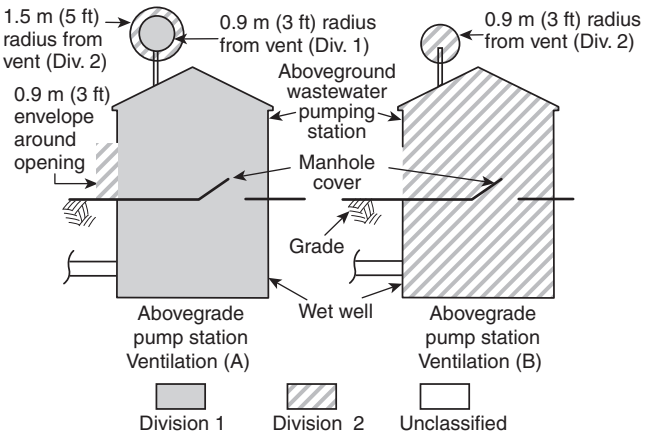

Note: Ventilation codes defined in Table 4.2.2 notes.

**Δ FIGURE A.4.2(c) Abovegrade Wastewater Pumping Station or Abovegrade Valve Vault Physically Separated from Wet Well or Basin; Illustration of Table 4.2.2, Rows 16 and 28.**




Note: Ventilation codes defined in Table 4.2.2 notes.

**Δ FIGURE A.4.2(d) Belowgrade or Partially Belowgrade Dry Well, Valve Vault or Metering Vault Physically Separated from Wet Well (wet well not shown in diagrams); Illustration of Table 4.2.2, Rows 5, 15, 29, and 34.**




Note: Ventilation codes defined in Table 4.2.2 notes.

**Δ FIGURE A.4.2(e) Abovegrade Wastewater Pumping Station Not Physically Separated from Wet Well; Illustration of Table 4.2.2, Row 17.**

The following is extracted from the UL Product iQ product category guide for listed gas detectors (JTPX):

Gas or vapor detectors should be calibrated and inspected by the operator in compliance with the manufacturer's instructions, as performance of the instruments will depend on proper maintenance. The instruments should be calibrated with known gas– or vapor–air mixtures at intervals and particularly after replaceable sensors incorporated in the detecting unit are replaced. Certain gases or vapors can adversely affect (poison) the sensors and limit the use of the instruments. Sampling atmospheres containing gases or vapors for which they have not been previously calibrated should, therefore, be avoided.

***N* A.7.4** Other fire protection system equipment might include items such as combustible gas detectors, radio communications equipment, and flame arresters or flame checks.

**A.7.6.2** Other types of detectors, such as heat and smoke detectors, have standards recommending spacing usually based on a certain area per detector. There are no known recognized standards or guidelines for the locating or spacing of combustible gas detectors.

Whether natural or mechanical, air movement is a very important consideration in installing combustible gas detectors. This aspect should be carefully investigated, including the effect of doors, windows, vents, and other openings. It could be necessary to conduct a ventilation study that could involve a nontoxic smoke movement analysis.

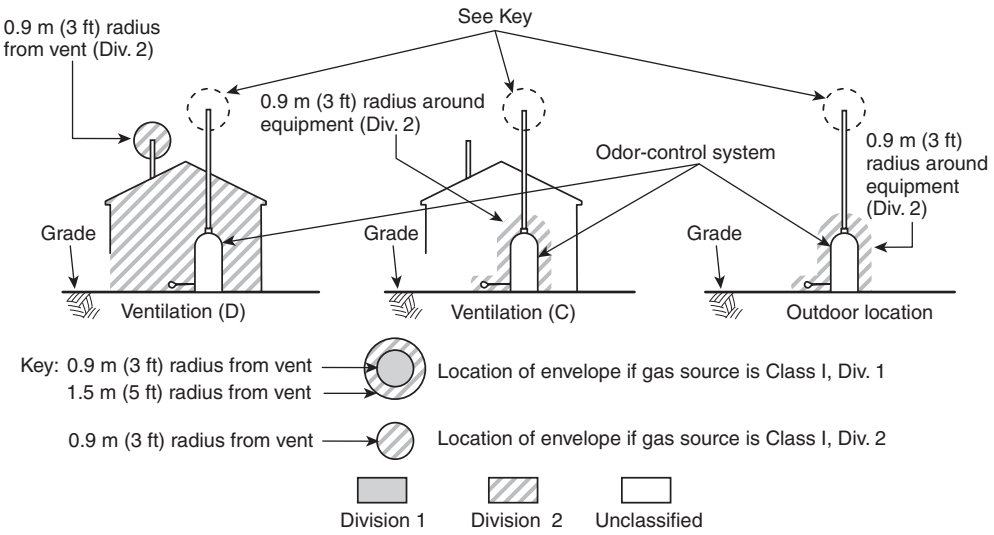
Dispersion characteristics can also affect detector placement. Vapors and gases will disperse inversely proportional to their specific density in a quiescent environment. Vapors and gases with densities less than that of air will diffuse quickly at first until the vapor or gas becomes diluted. Heavier-than-air vapors and gases will tend to settle at a low area and not diffuse into the atmosphere unless dispersed by ventilation or temperature currents. Vapors with densities close to that of air will exhibit little mixing effect and will be transported largely by air currents.

There are various types of sensing devices. It is important to select the proper sensing device for each application and for the environment in which it will be placed. Most organic and inorganic compounds can be monitored safely with a catalytic combustion–type sensor. However, organic and metallic solvents containing lead, silicones, plasticizers, or halogens can poison the catalytic element.

Qualified means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

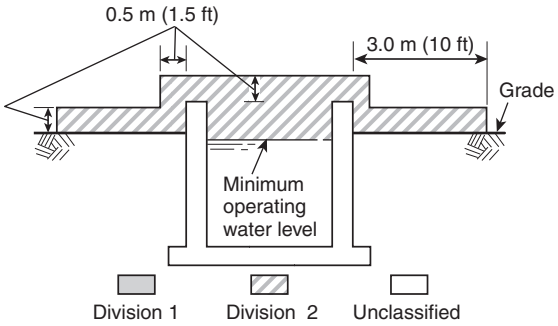
**Δ A.7.6.3** Combustible gas detectors required in this standard are intended primarily for fire protection. It should be noted that the combustible gas detectors installed in this standard do not take the place of or negate the need for personal gas (atmosphere) monitors required when entering a confined space. Refer to Chapter 7 of NFPA 350.

Note: Informational Note No. 1: See ANSI/UL 121303, *Guide for Use of Detectors for Flammable Gases*, or ANSI/FM 121303, *Guide for Use of Detectors for Flammable Gases*, for additional information. [**70:**500.7(K)(1)]




Note: Ventilation codes defined in Table 4.2.2 notes.

**Δ FIGURE A.4.2(f) Odor-Control System; Illustration of Table 4.2.2, Row 18.**




**Δ FIGURE A.5.2 Primary Sedimentation Tank and Aeration Basin; Illustration of Table 5.2.2, Rows 7(c) and 9(c).**

Note: Informational Note No. 2: See ANSI/UL 60079-29-1, *Explosive Atmospheres — Part 29-1: Gas Detectors — Performance Requirements of Detectors for Flammable Gases*, or ANSI/FM 60079-29-1, *Explosive Atmospheres — Part 29-1: Gas Detectors — Performance Requirements of Detectors for Flammable Gases*, for additional information. [**70:**500.7(K)(1)]

Note: Informational Note No. 3: See ANSI/API RP 500, *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2*, for additional information. [**70:**500.7(K)(1)]

Note: Informational Note No. 4: See ANSI/UL 60079-29-2, *Explosive Atmospheres — Part 29-2: Gas Detectors — Selection, Installation, Use and Maintenance of Detectors for Flammable Gases and Oxygen*, or ANSI/FM-60079-29-2, *Explosive Atmospheres — Part 29-2: Gas Detectors — Selection, Installation, Use and Maintenance of Detectors for Flammable Gases and Oxygen*, for additional information. [**70:**500.7(K)(1)]

**A.7.6.6** Infrared (IR) line-of-sight combustible gas detection sensors provide a detection level of LEL per meter (LEL-m).

**A.7.8.1** In all cases, standard "Danger" signs identifying the purpose of the lights and audible alarms and warning against entry when there is an alarm condition should be posted as near as practicable to the warning devices.

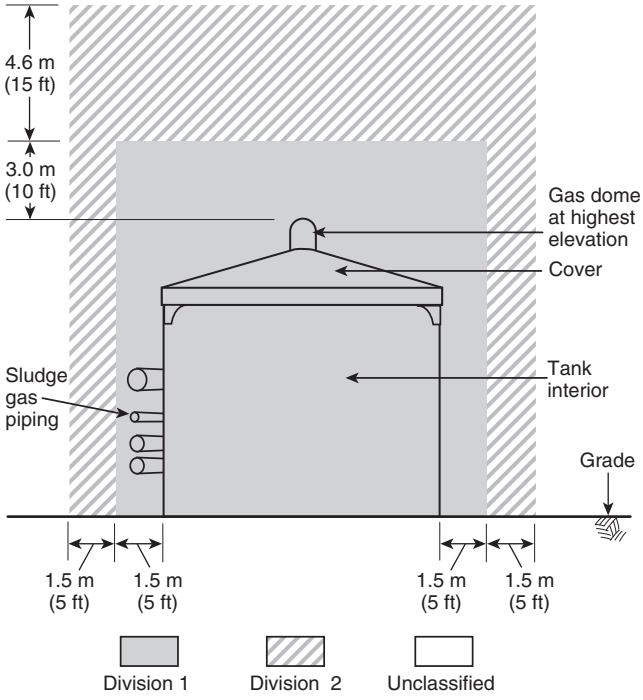
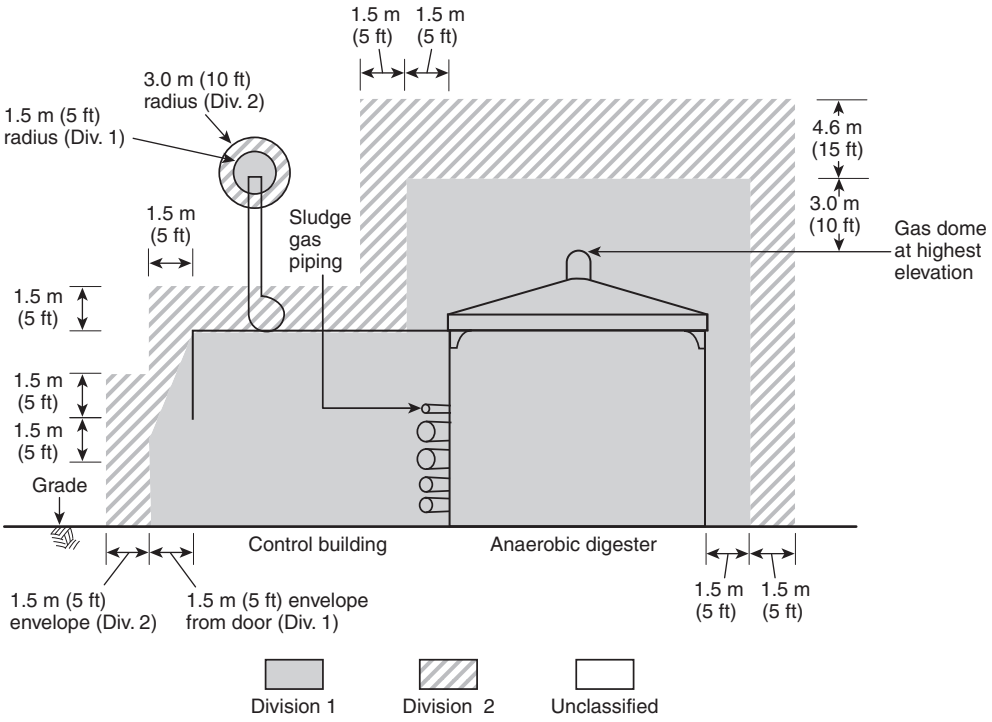


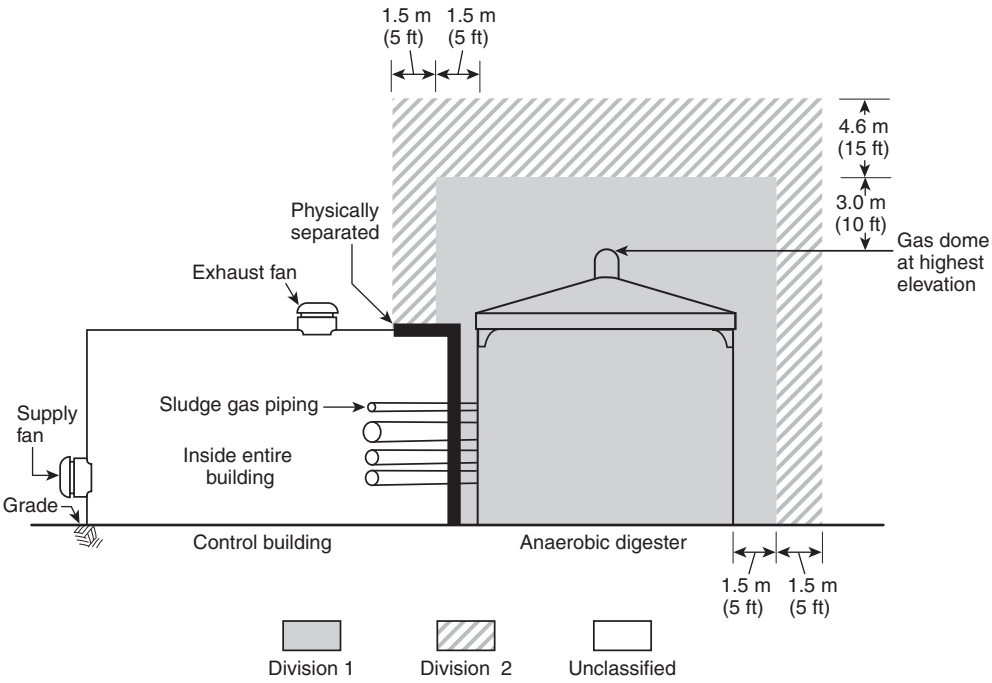

**FIGURE A.6.2(a) Anaerobic Digester with Fixed or Floating Cover Above Grade Not Enclosed in a Building; Illustration of Table 6.2.2(a), Rows 16a and 16b.**

***N* A.7.8.2** The dual visual warning system (e.g., green light, red light) is permitted to indicate inadequate ventilation for locations that are not constantly monitored.

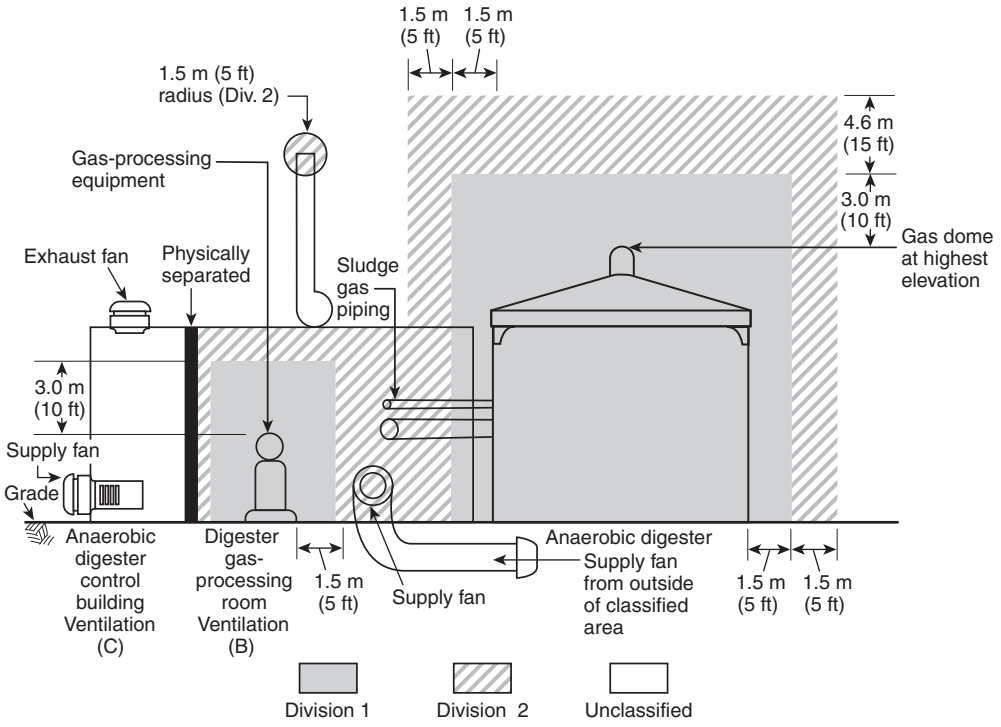
**A.7.8.4** Spacing and location of alarms depends on many factors and will vary from site to site. In the absence of any specific requirements, *NFPA 72* can be used as a guide.




**Δ FIGURE A.6.2(b) Anaerobic Digester Control Building Containing Sludge Gas Piping and Using Ventilation Method (A); Illustration of Table 6.2.2(a), Rows 17a, 17b, and 17c.**




**Δ FIGURE A.6.2(c) Anaerobic Digester Control Building Containing Sludge Gas Piping and Using Ventilation Method (C); Illustration of Table 6.2.2(a), Row 17d.**




Note: Ventilation codes defined in Table 6.2.2(a) notes.

Δ **FIGURE A.6.2(d) Anaerobic Digester Control Building Containing Sludge Gas–Processing Equipment Physically Separated and Using Ventilation Method (B) for the Processing Room and Ventilation Method (C) for the Control Building; Illustration of Table 6.2.2(a), Rows 17d and 18b.**

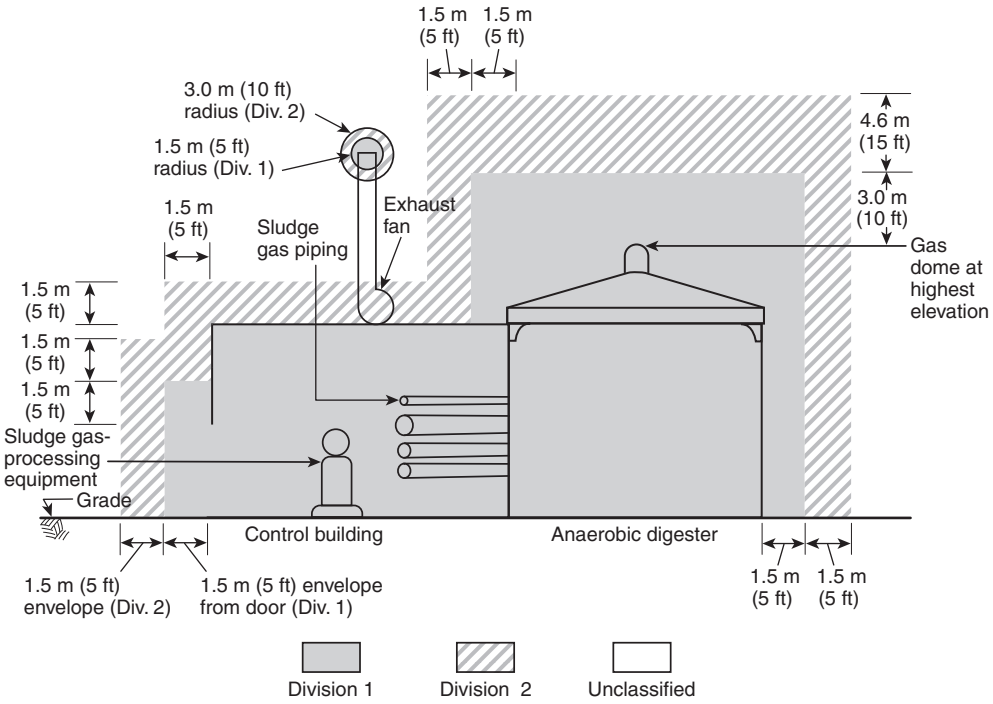
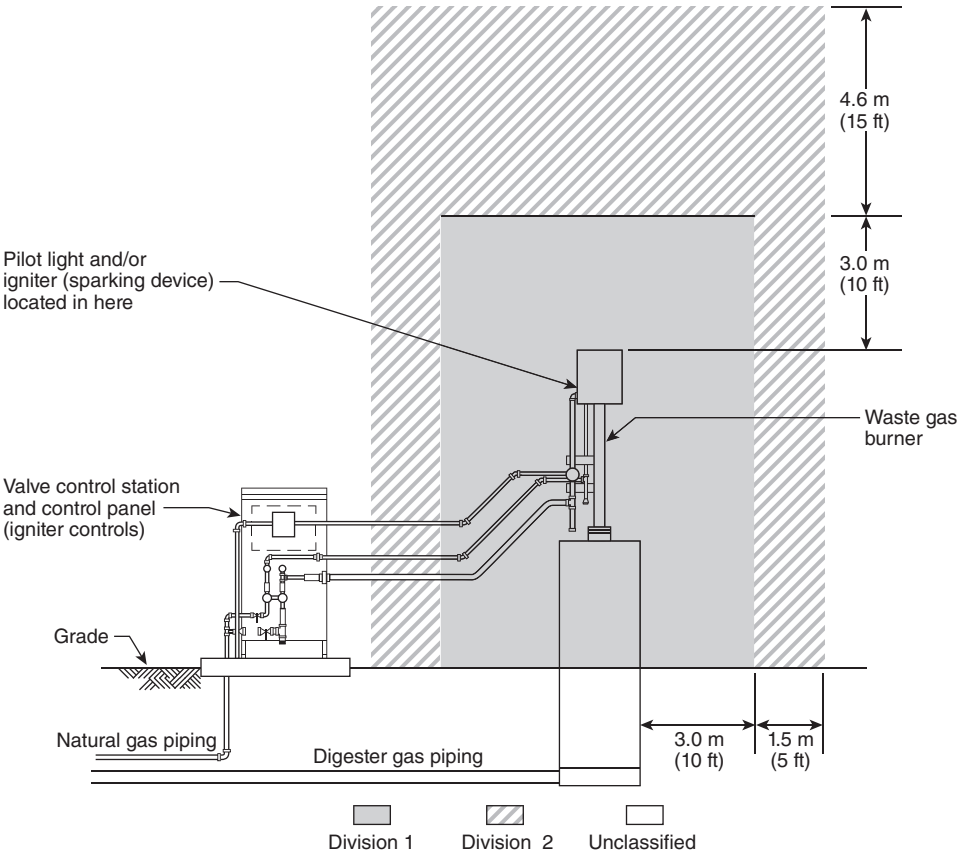



**FIGURE A.6.2(e) Anaerobic Digester Control Building Containing Sludge Gas–Processing Equipment not Physically Separated and Using Ventilation Method (A); Illustration of Table 6.2.2(a), Row 17.**




N **FIGURE A.6.2(f) Waste Gas Burner; Illustration of Table 6.2.2(a), Row 20(c).**

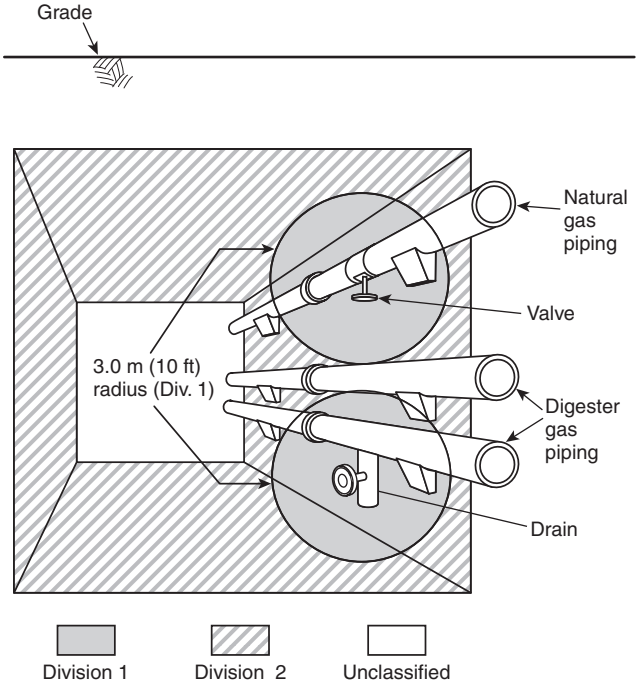



**FIGURE A.6.2(g) Underground Tunnel Containing Natural Gas or Sludge Gas Piping and Using Ventilation Method (D); Illustration of Table 6.2.2(a), Rows 22a and 22b.**

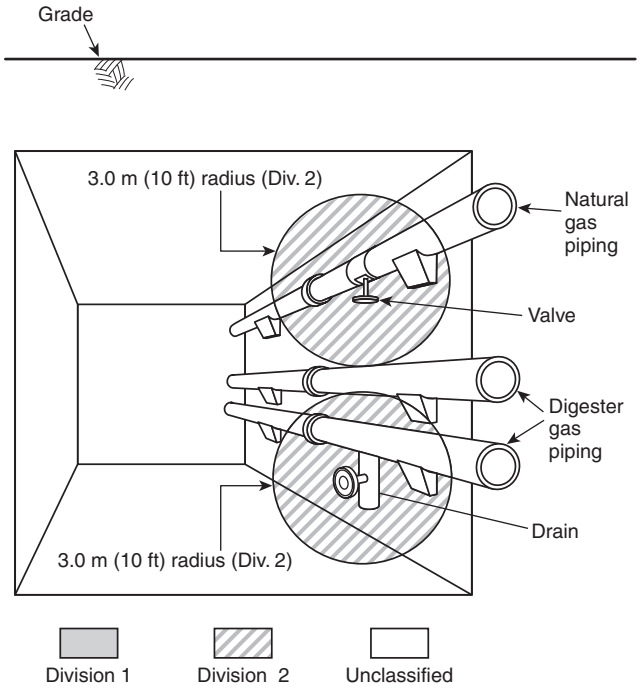



**FIGURE A.6.2(h) Underground Tunnel Containing Natural Gas or Sludge Gas Piping and Using Ventilation Method (C); Illustration of Table 6.2.2(a), Rows 22c and 22d.**

*N* **A.7.8.6** The degradation of field devices can be highly variable depending on contaminants in the ambient environment. Therefore, alarm system testing frequency can vary based upon site-specific conditions.

**A.7.11** Impairments to fire protection systems should be as short in duration as practicable. If the impairment is planned, all necessary parts and manpower should be assembled prior to removing the protection system from service. When an impairment is not planned, the repair work should be expedited until repairs are completed.

**A.8.1.1** For more information on building construction types refer to the applicable building code or *NFPA 5000* and NFPA 220. These NFPA documents provide additional details and cross-references for the building construction types described in four other model building codes. For AHJs where one of these model building codes are used, the cross references provide helpful information to assist in the proper application of the materials of construction requirements in NFPA 820.

Δ **A.8.2.2(5)** The smoke developed index is assessed by means of testing via ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

**A.8.2.3.1** The provisions of 7.1.4.1 of *NFPA 5000* do not require inherently noncombustible materials to be tested in order to be classified as noncombustible materials.

**A.8.2.3.1(1)** Examples of such materials include steel, concrete, masonry, and glass.

**A.8.2.3.2** Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric conditions are considered combustible. *(See NFPA 259 and NFPA 220.)*

**A.8.3.2** Buildings and structures, including domes and covers, containing unit processes that are critical to maintaining the integrity of the treatment plant (e.g., headworks, main pumping facility, primary clarifiers), and that if out of service for even a few hours could permanently damage the environment or endanger public health by allowing the release of raw wastewater or sludge.

**A.8.3.3** Buildings or structures, including domes and covers, containing unit processes that are essential to maintaining the integrity of the treatment plant (e.g., secondary biological treatment, secondary clarifiers, or disinfection facilities), and that if out of service for short periods of time would not permanently damage the environment or endanger public health but would become critical if out of service for several days.

**A.8.3.3.2** Plastic or fiberglass-reinforced plastic products are often used as materials of construction in unit processes such as rotating biological contactors (RBC), bio-towers, trickling filters, inclined plate (tube) settlers, ventilation ducts, and other equipment that might be subject to corrosion. Under normal operating conditions, these plastic or fiberglass-reinforced plastic materials might be submerged. However, during maintenance or repair, they can become exposed. During maintenance and repair operations, extreme care should be taken with open flame such as cutting torches, because these exposed plastic or fiberglass-reinforced plastic materials might present a considerable fuel load if ignited.

**A.8.3.4** Buildings and structures containing unit processes that generate, process, or utilize combustible gases (e.g., anaerobic wastewater treatment processes, anaerobic digesters, compressors, storage spheres, piping, waste gas burners, gas-fired equipment including sludge incinerators) should be constructed of materials meeting the definition of noncombustible.

**A.8.3.5** See Annex C of this document.

**A.8.3.7** Buildings and structures containing unit processes, including sludge-processing operations, that are not critical or essential to maintaining the integrity of the treatment plant, and that if out of service for long periods of time (i.e., a week or more) would not permanently damage the environment or endanger public health, should be constructed of materials considered applicable by the authority having jurisdiction.

**A.9.1.1.2** Ventilation rates and procedures established by this standard might not be sufficient to protect personnel from exposure to toxic gases that might be present in enclosed spaces. For further information, refer to NFPA 350; *Industrial Ventilation — A Manual of Recommended Practice for Design*, published by the American Conference of Governmental Industrial Hygienists (ACGIH); and 29 CFR 1910.1000, "Air Contaminants." Where other standards require higher ventilation rates, the higher ventilation rate should be used.

*N* **A.9.2.1** Ventilation system designers and installers should review the requirements of Chapter 4 of NFPA 91. Such requirements include the need to complete a documented risk analysis if the risk of damage from fire and the products of combustion would be higher than air-moving devices operating. NFPA 91 permits a fire detection and alarm system inter-

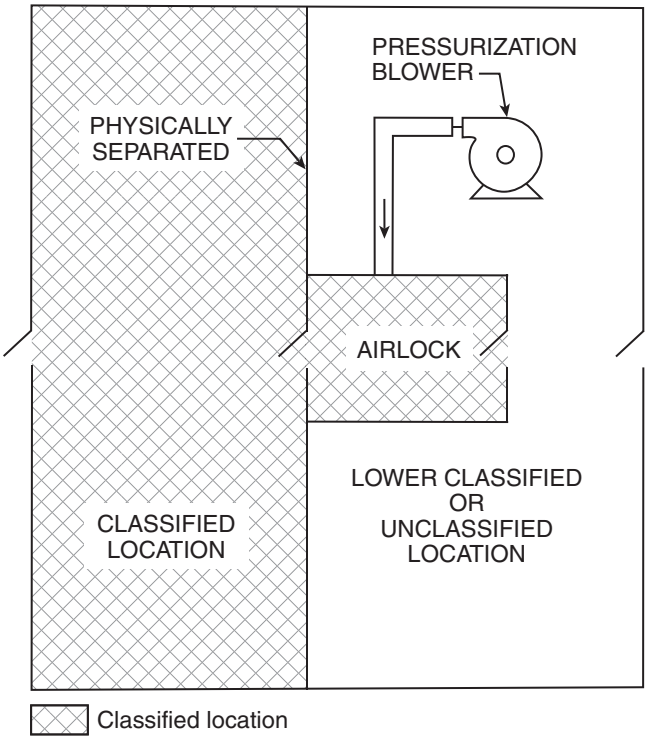
lock to shut down air-moving devices with an appropriate risk assessment.

**A.9.4** A gastight partition between two adjacent spaces, or two nonadjacent spaces, with no means of gas communication between the spaces and where personnel entry into the spaces is by individual, exterior access ports with no physical connection is the preferred protection method of providing a physical separation. *(See Figure A.9.4.)*

**A.10.2.1** Proper preventive maintenance of operating and fire protection equipment as well as operator training are important aspects of a viable fire prevention program.

**A.10.3** A fire and explosion risk assessment of a plant should result in recommendations for integrating the fire prevention and protection required in this document into plant-specific considerations regarding its design, layout, and anticipated operating requirements. The evaluation should result in a list of recommended fire prevention features to be provided based on acceptable means for the separation or control of common and special hazards, the control or elimination of ignition sources, and the suppression of fires.

This assessment should focus on the materials of construction in ventilation systems and processes that normally operate in a wet condition—for example, plastic media trickling filters, bio-towers, and rotating biological contactors. These systems and process units can represent a considerable fuel load if ignition occurs during operation. Maintenance, fire spread, and smoke production should be considered in the selection of materials. Consideration should also be given to the location of process areas—for example, screen rooms, areas containing gas management equipment, and so forth—as they can represent a significant explosion hazard remote from other process areas.




**Δ FIGURE A.9.4 Typical Airlock System Serving a Hazardous (i.e., Classified) Location.**

Once a fire and explosion risk assessment (FERA) is complete, the concepts for evaluating the FERA can be found in NFPA 551.

The application of codes and standards can help manage the risks associated with wastewater treatment facilities; however, NFPA 820 cannot address all the fire and explosion hazards unique to a given process or site. A FERA can serve as an effective tool to minimize and manage fire and explosion risks. If a facility is required to conduct a process hazard analysis (PHA) under the OSHA Process Safety Management (PSM) standard (29 CFR 1910.119) or develop an EPA Risk Management Plan (RMP), a FERA can be incorporated into that process. The results of a FERA or the relevant portions of a PHA related to fires and explosions can be used to manage these risks.

A PHA is an organized and systematic effort to identify and analyze the hazards associated with a process, and it involves the application of a structured technique or methodology, such as a checklist analysis, a what-if analysis, a hazard and operability (HAZOP) study, etc. The Center for Chemical Process Safety (CCPS) provides multiple resources—such as *Guidelines for Risk Based Process Safety*—to support process hazard identification, analysis, and risk management (www.aiche.org/ccps).

A FERA for existing facilities can be very valuable. Examples of potential issues for revalidation include the following:

(1) Areas that were once rated as hazardous now have nonrated electrical devices
(2) The condition of once hazardous area-rated devices has been compromised
(3) Ventilation changes for new processes have impacted pressurization and/or air changes in adjacent areas

For both new and existing installations, the intent is to perform a FERA to identify fire and explosion hazards and assist in developing mitigation strategies to minimize the risk posed by those hazards. A FERA can be applied to all classes of equipment and processes, but the complexity of the FERA should match the circumstances. For example, simple methods involving increases in the size of like-for-like systems could be acceptable by following only the prescriptive requirements of the standard. Applying a FERA can better address more complex processes incorporating changing techniques.

29 CFR, Part 1910.119, Appendix C says that a FERA team can vary in size from two to several people with varied operational and technical backgrounds. Some team members might only be part of the team for a limited time. The facilitator or team leader must be knowledgeable in adequately implementing the FERA methodology and impartial in the evaluation. The other full or part-time team members need to provide the team with expertise in areas such as process technology, process design, and operating procedures and practices, including how the work is performed, alarms, emergency procedures, instrumentation, maintenance procedures, both routine and nonroutine tasks, how changes are authorized, procurement of parts and supplies, safety and health, and any other relevant subject as need dictates. At least one team member must be familiar with the process.

Furthermore, the ideal team should include members with intimate knowledge of the standards, codes, specifications, and regulations applicable to the process. The team should work together while benefiting from the expertise of others on the team or outside the team to resolve issues and forge a consensus on the findings of the study and recommendations.