NFPA®

820

Standard for Fire Protection in Wastewater Treatment and Collection Facilities

2020

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NFPA® 820

Standard for

Fire Protection in Wastewater Treatment and Collection Facilities

2020 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 28, 2019, with an effective date of May 18, 2019, and supersedes all previous editions.

This edition of NFPA 820 was approved as an American National Standard on May 18, 2019.

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 associated collection systems. This document includes the hazard classification of specific areas and processes. The need to develop NFPA 820 was based on fire or explosion incidents that, while infrequent, are relatively severe when they do occur. Initial work on the document was begun early in 1985 and resulted in the first edition being issued in 1990. Extensive changes were made between the first edition and the 1992 edition, 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 document scope was revised to include storm sewer systems and their appurtenances.

In 1995 the document was changed from a recommended practice to a standard, which contains 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 to make the document more enforceable. The definitions were also modified to conform to 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*. Definitions were revised to conform to the NFPA *Glossary of Terms*.

The 2008 edition included guidance on waste gas burners and enclosed aeration basins. Definitions were coordinated 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, along with mitigation steps to Section 10.11 on fire and explosion prevention control procedures. Ventilation requirements and supporting language were revised to provide clarity and to tie in with an effort to better coordinate with associated industry documents.

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

The 2020 edition has been updated to cover the protection of pressure sewers. All caution text throughout the document has been moved to the annex. New sections have been added to

emphasize the importance of monitoring for flammable atmospheres prior to the performance of work that could introduce a source of ignition. The definition for *physical separation* has been updated to clarify that personnel entry into physically separated spaces is by individual, exterior access ports with no physical connection. In addition, the 2020 edition now permits the use of an airlock as an alternative means of providing a physical separation.

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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

2020 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 E.

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 3.3.58.1)*

1.1.3 This standard shall not apply to the following:

(1) On-site treatment systems *(see 3.3.42)*
(2) Building drain systems and appurtenances *(see 3.3.6)*
(3) Industrial sewer systems and appurtenances *(see 3.3.52.5)*
(4) Personnel safety from toxic and hazardous materials or products of combustion
(5) Separate nonprocess-related structures *(see 3.3.58.2)*

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 the effects of fire or explosion 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.

Δ **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.

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1.3.3 Ventilation Practices. Ventilation rates required by this standard are deemed only to minimize fire and explosion hazards. *(See 1.3.2.2 and 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 permitted 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.

Δ **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 U.S. customary units.

1.6.2 For metric conversion practices, see IEEE/ASTM SI 10, *Use of the International System of Units (SI): the Modern Metric System*.

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.

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

NFPA 1, *Fire Code,* 2018 edition.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2018 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam,* 2016 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 2018 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems,* 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2019 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2019 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection,* 2017 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems,* 2019 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems,* 2017 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection,* 2019 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection,* 2018 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* 2019 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2020 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2018 edition.

NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals,* 2019 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work,* 2019 edition.

NFPA 54, *National Fuel Gas Code,* 2018 edition.

NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems,* 2017 edition.

NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities,* 2017 edition.

NFPA 68, *Standard on Explosion Protection by Deflagration Venting,* 2018 edition.

NFPA 69, *Standard on Explosion Prevention Systems,* 2019 edition.

NFPA 70®, *National Electrical Code*®, 2020 edition.

NFPA *70E*®, *Standard for Electrical Safety in the Workplace*®, 2018 edition.

NFPA 72®, *National Fire Alarm and Signaling Code*®, 2019 edition.

NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment,* 2019 edition.

NFPA 85, *Boiler and Combustion Systems Hazards Code,* 2019 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems,* 2018 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids,* 2015 edition.

NFPA 92, *Standard for Smoke Control Systems,* 2018 edition.

NFPA 204, *Standard for Smoke and Heat Venting,* 2018 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations,* 2019 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials,* 2018 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,* 2017 edition.

NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas,* 2017 edition.

NFPA 600, *Standard on Facility Fire Brigades,* 2015 edition.

NFPA 601, *Standard for Security Services in Fire Loss Prevention,* 2015 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 780, *Standard for the Installation of Lightning Protection Systems,* 2020 edition.

NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting,* 2017 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 2018 edition.

2.3 Other Publications.

N **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.

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

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* 2018.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C,* 2016a.

ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C,* 2016.

ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter,* 2017.

IEEE/ASTM SI 10, *Use of the International System of Units (SI): the Modern Metric System,* 2016.

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

ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials,* 2008, revised 2013.

2.3.4 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 30, *Flammable and Combustible Liquids Code,* 2018 edition.

NFPA 70®, National Electrical Code®, 2017 edition.

NFPA *101®, Life Safety Code®,* 2018 edition.

NFPA 652, *Standard on the Fundamentals of Combustible Dust,* 2016 edition.

NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials,* 2014 edition.

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

NFPA 5000®, Building Construction and Safety Code®, 2018 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 phrase "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.

N **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***, 2018]

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.

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3.3.8 Classification of Locations.

N **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.

N **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 Attended 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:**100]

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**, 2014]

3.3.22 Fire Protection. Methods of providing for fire control or fire extinguishment. [**801**, 2014]

3.3.23* Flame Spread Index. See 8.2.3.4.

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:**100]

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.

3.3.34.1* ***Combustible Liquid.*** Any liquid that has a closed-cup flash point at or above 100°F (37.8°C), as determined by the test procedures and apparatus set forth in Section 4.4 of NFPA 30. Combustible liquids are classified according to Section 4.3 of NFPA 30. [**30,** 2018]

3.3.34.2* ***Flammable Liquid.*** A liquid that has a closed-cup flash point that is below 37.8°C (100°F) and a maximum vapor pressure of 2068 mm Hg (absolute pressure of 40 psi) at 37.8°C (100°F).

3.3.34.3 ***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**, 2018]

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.

3.3.39.1 ***Limited-Combustible Material.*** See 8.2.3.3.

3.3.39.2 ***Noncombustible Material.*** See 8.2.3.2.

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.)*

3.3.41 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.

3.3.42 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.

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

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

3.3.45* 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.

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

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

N **3.3.48 Replacement-in-Kind.** A replacement that satisfies the design specifications of the replaced item. [**652,** 2016]

3.3.49 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).

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

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

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

3.3.52.1 ***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.

3.3.52.2 ***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.

3.3.52.3 ***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.

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

3.3.52.5 ***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 pre-treatment in accordance with federal or state requirements before discharge to a municipal sewer system. *(See also 3.3.52.8, Sanitary Sewer; 3.3.52.9, Storm Sewer; and 3.3.52.4, Combined Sewer.)*

3.3.52.6 ***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.

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3.3.52.7 ***Residential Sewer.*** A sewer intended to receive only residential, domestic wastewater. *(See also 3.3.52.4, Combined Sewer; 3.3.52.8, Sanitary Sewer; and 3.3.52.9, Storm Sewer.)*

3.3.52.8 ***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.

3.3.52.9 ***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).

3.3.52.10 ***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.

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

3.3.53.1 ***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.

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

3.3.55 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.

3.3.56 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.

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

3.3.58 Structure. That which is built or constructed and limited to buildings and nonbuilding structures as defined herein. [**5000,** 2018]

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

3.3.58.2 ***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.

3.3.59 Tank.

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

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

3.3.60 Treatment.

3.3.60.1 ***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.

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

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

3.3.60.4 ***Wastewater Treatment.***

3.3.60.4.1* ***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.

3.3.60.4.2 ***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.

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

3.3.61 Tunnel. See 3.3.27, Galleries.

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

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

3.3.64 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.

3.3.65 Waste.

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

3.3.66* 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.

3.3.67 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.

3.3.67.1 ***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.

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

3.3.68 Well.

3.3.68.1* ***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.

3.3.68.2* ***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.

4.1.1 This chapter shall establish minimum criteria for protection against fire and explosion hazards in the collection and transportation of municipal wastewater.

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

N **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.

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

N **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.

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

N **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.

Δ **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.

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.

N **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.

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

N **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.

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

N **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.

Δ **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 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 Sewer transporting industrial wastewater only (no sanitary wastewater)	Not included within the scope of this standard					
3		STORM SEWER Sewer transporting storm water only (no sanitary wastewater)	Possible ignition of flammable gases and floating flammable liquids	NNV	Inside of sewer	Division 2	In accordance with 8.3.5	NR
4		STORM WATER PUMPING STATION WET WELLS Liquid side of pumping station serving only a storm sewer system	Possible ignition of flammable gases and floating flammable liquids	NNV	Entire room or space	Division 2	NC, LC, or LFS	NR
5	a	STORM WATER PUMPING STATION DRY WELLS	Buildup of vapors from flammable or combustible liquids	D	Entire dry well	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 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 (Lateral sewer or drain) Sewer serving a house or single building (plumbing)	Not included within the scope of this standard					
8		INDIVIDUAL RESIDENTIAL SEWER Sewer serving one or more individual residences with a total flow of not more than 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 Pumping units serving one or more individual residences with a total flow of not more than 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 flammable liquids	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 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 flammable liquids	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 flammable liquids	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 flammable liquids	A	Entire room or space	Division 1	NC, LC, or LFS	CGD required if mechanically ventilated or opens into a building interior
	b	Liquid side of a pumping station serving a sanitary sewer or combined system		B	Entire room or space	Division 2	NC, LC, or LFS	CGD (if enclosed)
15	a	BELOWGRADE OR PARTIALLY BELOWGRADE WASTEWATER PUMPING STATION DRY WELL	Buildup of vapors from 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	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
16		ABOVEGRADE WASTEWATER PUMPING STATION 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 flammable liquids	A	Entire space or room	Division 1	NC	FE
	b	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	Division 2	NC, LC, or LFS	FE
18	a	ODOR-CONTROL AND VENTILATION SYSTEMS SERVING CLASSIFIED LOCATIONS	Leakage and ignition of flammable gases and vapors	D	Entire area if enclosed	Division 2	NC, LC, or LFS	CGD and FAS
	b			C	Areas within 0.9 m (3 ft) of leakage sources such as fans, dampers, flexible connections, flanges, pressurized unwelded ductwork, and odor-control vessels	Division 2	NC, LC, or LFS	CGD and FAS
	c			C	Areas beyond 0.9 m (3 ft)	Unclassified	NC, LC, or LFS	CGD and FAS
	d			Not enclosed, open to the atmosphere	Areas within 0.9 m (3 ft) of leakage sources such as fans, dampers, flexible connections, flanges, pressurized unwelded ductwork, and odor-control vessels	Division 2	NC, LC, LFS	FE
	e			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 flammable liquids	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 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 Depressed section of gravity sewer	Possible ignition of flammable gases and floating flammable liquids	NNV	Interior of inlet and outlet structures	Division 1	NC	NR
22		CATCH BASINS (Curb inlet) Inlet where street water enters a storm or combined sewer	Buildup of vapors from 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 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 VALVE VAULT	Possible ignition of gases and floating flammable liquids	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 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 METERING VAULT	Possible ignition of flammable gases and floating flammable liquids	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 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 Physically separated from the wet well; valves in vault in closed piping system	N/A	NR	N/A	Unclassified	NC, LC, or LFS	NR
29	a	BELOWGRADE VALVE VAULT	Buildup of vapors from flammable or combustible liquids	NNV	Enclosed space	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 VALVE VAULT	Possible ignition of gases and floating flammable liquids	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
31	a	CONTROL STRUCTURES	Buildup of vapors from 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 flammable liquids	A	Enclosed space	Division 1	NC	NR
	b	Enclosed structures temporarily holding untreated or partially treated wastewater		B	Enclosed space	Division 2	NC, LC, or LFS	NR
33		WASTEWATER HOLDING BASINS, LINED OR UNLINED Open structures holding storm water, combined wastewater, untreated or partially treated wastewater	NR	NR	NR	NR	NR	NR
34	a	BELOWGRADE METERING VAULT	Buildup of vapors from flammable or combustible liquids	NNV	Enclosed space	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 METERING VAULT	Possible ignition of flammable gases and floating flammable liquids	NNV	Enclosed space	Division 1	NC	NR
	b	With an exposed wastewater surface		B	Enclosed space	Division 2	NC, LC, or LFS	NR
36		COARSE AND FINE SCREEN FACILITIES *(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 extinguisher
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.

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 flammable liquids	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 Removal of screenings from raw wastewater	Possible ignition of flammable gases and floating flammable liquids	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 Storage of raw or partially treated wastewater	Possible ignition of flammable gases and floating flammable liquids	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 flammable liquids	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	PRE-AERATION TANKS Conditioning of wastewater prior to further treatment	Possible ignition of flammable gases and floating flammable liquids	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 flammable liquids	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 flammable liquids	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 flammable liquids	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 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 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 Tanks for aerobic treatment of wastewater using high-purity oxygen rather than air	Ignition of flammable gases and floating flammable liquids 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 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 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 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 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 Filtering of treated wastewater through sand or other media	N/A	NR	N/A	Unclassified	NR	H
23		CARBON COLUMN OR TANKS 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 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 Tanks for temporary storage of backwash water	N/A	N/A	N/A	Unclassified	NR	H
26		ULTRAVIOLET DISINFECTION UNIT 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 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 *(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 extinguisher.
H: Hydrant protection in accordance with 7.2.4.
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.

N **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.

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

N **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.

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

N **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.

Δ 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).

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 non-water 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 16
(6) NFPA 17
(7) NFPA 2001

7.2.4 Water Supplies, Standpipes, Hose Systems, and Hydrants.

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

7.2.4.1.1 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.

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

Δ 7.2.4.2 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

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

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 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 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 flammable liquids 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
4	a	SCUM PITS	Buildup of vapors from 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 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

(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
6	a	SCUM-PUMPING AREAS	Buildup of vapors from 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[c,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
8	a	SLUDGE THICKENER Sludge concentration and removal, gravity, or dissolved air flotation	Possible generation of methane from sludge; carryover of floating flammable 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			C	Enclosed — entire space	Unclassified if process is preceded by primary treatment with skimming	NC	H and FE
	d			Not enclosed, open to atmosphere	Envelope 0.46 m (18 in.) above water surface and 3 m (10 ft) horizontally from wetted 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
10	a	SLUDGE STORAGE WET WELLS, PITS, AND HOLDING TANKS	Possible generation of methane gas in explosive concentrations; carryover of floating flammable liquids	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	Envelope 0.46 m (18 in.) above water surface and 3 m (10 ft) horizontally from wetted 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 flammable liquids	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	Envelope 0.46 m (18 in.) above water surface and 3 m (10 ft) horizontally from wetted 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 Conveying and burning of sludge cake	Firebox explosion	NR	N/A	Unclassified	NC, LC, or LFS	FAS and FSS (if indoors), H, and FE
15		HEAT TREATMENT UNITS, LOW- OR HIGH-PRESSURE OXIDATION UNITS Closed oxidation of sludge	None, other than in high-pressure systems	NR	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
16	a	ANAEROBIC DIGESTERS, BOTH FIXED ROOF AND FLOATING COVER 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 4.6 m (15 ft) above Division 1 area over cover and 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
17	a	ANAEROBIC DIGESTER CONTROL BUILDING	Leaking and ignition of sludge gas	A	Entire building	Division 1	NC	CGD, H, and FE
	b	Storage, handling, or burning of sludge gas		B	Enclosed areas that contain gas-handling equipment	Division 2	NC, LC, or LFS	CGD, H, and FE
	c			C	Physically separated from gas-handling equipment	Unclassified	NC, LC, or LFS	CGD, H, and FE
18	a	DIGESTER GAS-PROCESSING ROOMS	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	Entire room	Division 2	NC, LC, or LFS	CGD, 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

(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
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
21		CHLORINE OXIDATION UNITS 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, FDS, 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, FDS, 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, FDS, and FE
	d			C	Areas beyond 3 m (10 ft)	Unclassified	NC, LC, or LFS	CGD, FDS, and FE
23		UNDERGROUND (PIPING) TUNNELS NOT CONTAINING NATURAL GAS PIPING OR SLUDGE GAS PIPING 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	FDS 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	
	b	Aerobic sludge reduction		C	Enclosed area	Unclassified	NC, LC, or LFS	H, FAS, and FSS
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

(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
26		ODOR-CONTROL AND VENTILATION SYSTEMS SERVING CLASSIFIED LOCATIONS *(See Table 4.2.2)*						
27		PUMPING OF DRAINAGE FROM DIGESTED SLUDGE-DEWATERING PROCESSES 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 extinguisher
FSS: Fire suppression system (e.g., automatic sprinkler, water spray, foam, gaseous, or dry chemical)
H: Hydrant protection in accordance with 7.2.4
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 7.2.4
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 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 flammable or combustible liquids, see NFPA 30.
[f]The area beyond the envelope is unclassified.

7.2.4.4 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.

7.2.5 Portable Fire Extinguishers.

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

7.2.5.2 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.

7.3 Fire Alarm Systems.

Δ **7.3.1** 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*.

Δ **7.3.2** Fire alarm systems shall include automatic initiating devices.

7.4 Combustible Gas Detection.

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

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

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

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

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

Δ **7.4.6*** 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.

7.4.6.1 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.

N **7.4.7** 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 7.6.

7.5 Ventilation Monitoring.

7.5.1 All continuous ventilation systems that are used to reduce the classification of a space shall be fitted with flow detection devices connected to alarm signaling systems to indicate inadequate ventilation and ventilation system failure.

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

7.5.2 The alarm signaling systems shall comply with the requirements of Section 7.6.

7.6 Alarm Signaling Systems.

7.6.1* Distinct local and remote alarms shall be displayed in accordance with Table 7.6.1.

7.6.2* Local and remote alarms required in Table 7.6.1 shall be located to be readily heard and seen by responsible personnel.

7.6.3 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.

7.6.4 A telephone dialer shall be allowed to meet the intent of the constantly attended location listing in Table 7.6.1.

7.6.5 Visual and audible alarms required in Table 7.6.1 shall be tested quarterly to verify their functionality or in accordance with 7.6.6.

7.6.6 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.

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

7.8 Special Fire Protection Measures.

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

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

7.8.3 Drainage.

7.8.3.1 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.

Δ **Table 7.6.1 Location and Type of Alarm Signaling Notification Appliances Required in 7.6.1**

Location	Alarm Notification Appliances
Entrance(s) to spaces in occupied facilities	Visual and audible alarms
Entrances to remote spaces that are not constantly attended	Visual and audible alarms or a dual light warning system
Within spaces	Visual and audible alarms
Constantly attended location (local or remote)	Visual and audible alarms

7.8.3.2 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 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

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

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

8.2.3.1 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.

8.2.3.2* 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 Behavior of Materials in a Vertical Tube Furnace at 750 Degrees 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 Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750 Degrees C.*

[**5000:**7.1.4.1.1]

8.2.3.2.1 Where the term *limited-combustible* is used in this standard, it shall also include the term *noncombustible.* [**5000:**7.1.4.1.2]

Δ **8.2.3.3* Limited-Combustible Material.** A material shall be considered a limited-combustible material where both of the following conditions of 8.2.2(1), 8.2.2(2), and the conditions of either 8.2.3.3.1 or 8.2.3.3.2 are met:

(1) The material does not comply with the requirements for a noncombustible material in accordance with 8.2.3.
(2) The material, in the form in which it is used, exhibits a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg), when tested in accordance with NFPA 259.

[**5000:**7.1.4.2]

8.2.3.3.1 The material shall have a structural base of noncombustible material with a surfacing not exceeding a thickness of $\frac{1}{8}$ in. (3.2 mm) 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 ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials.* [**5000:**7.1.4.2.1]

8.2.3.3.2 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 ANSI/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 ANSI/UL 723. [**5000:**7.1.4.2.2]

N **8.2.3.3.3** Materials shall be considered limited-combustible materials where tested in accordance with ASTM E2965, *Standard Test for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Combustion Calorimeter*, at an incident heat flux of 75 kW/m^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 for longer than 10 seconds.
(2) The total heat released shall not exceed 8 MJ/m^2.

[**5000:**7.1.4.2.3]

8.2.3.3.4 Where the term *limited-combustible* is used in this standard, it shall also include the term *noncombustible.* [**5000:**7.1.4.2.4]

8.2.3.4* Flame spread index shall be considered 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, *Standard for Test for Surface Burning Characteristics of Building Materials*.

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.

8.3.8.2* Systems supplying or exhausting air at a rate greater than 56.6 m^3/min (2000 ft^3/min) shall include listed smoke dampers, listed fire dampers, and smoke detection that causes the ventilation system to shut down upon detection of smoke.

8.3.8.3 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 90A, NFPA 92, and NFPA 204.
(2) Smoke venting also shall be permitted to be accomplished using listed portable smoke ejectors.

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.

Δ **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.

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.

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 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.

9.2.4 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.

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.

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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.

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N **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 7.4
   (d) Alarm signaling system in accordance with Section 7.6 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.

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

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, 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 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 Water-Based Fire Protection Systems.

10.5.1 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 such 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

10.5.2 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.

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

10.6 Other Fire Protection and Detection Systems.

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

10.6.2* All other fire protection and detection systems shall be inspected, tested, and maintained in accordance with the NFPA standards in Chapter 2.

10.6.3 Other fire protection system equipment that is not addressed by an NFPA standard as referenced in Chapter 2 (e.g., combustible gas detectors, radio communications equipment, and flame arresters or flame checks) shall be inspected, tested, and maintained in accordance with the manufacturers' specifications.

10.7* Impairments.

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

10.7.2 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

10.7.3 Following repairs, tests shall be conducted on all affected systems to ensure operation.

10.7.4 Following restoration, all parties previously notified of the impairment shall be notified of the completion of repairs.

10.8 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

10.9* Fire Brigades.

10.9.1* If a fire brigade is provided, its organization and training shall be identified in written procedures.

10.9.2 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.

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

10.10* 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 **10.11 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 flammable and/or combustible liquids and gases
(8) Installation, maintenance, and use of equipment (e.g., electrical) in classified locations that present a source of ignition

10.11.1 Control of Hazardous Source.

10.11.1.1 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.

10.11.1.2 Liaison shall be implemented 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.

10.11.1.3 All storage, handling, and use of flammable and combustible liquids and gases shall comply with NFPA 30 and NFPA 54.

10.11.2 Control of Ignition Sources.

10.11.2.1* 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.

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

10.11.3 Hot Work Permits.

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

10.11.3.2 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.

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

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.

• *N* **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.1.3.2.2** 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.

N **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.

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, 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 documents in a broad manner, since 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.

Δ **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 Attended 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.

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.

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.

A.3.3.34.1 Combustible Liquid. Definition applies as determined by the test procedures and apparatus set forth in Chapter 4 of NFPA 30. Combustible liquids are classified as Class II or Class III as follows:

(1) Class II — any liquid that has a flash point at or above 37.8°C (100°F) and below 60°C (140°F)
(2) Class IIIA — any liquid that has a flash point at or above 60°C (140°F), but below 93°C (200°F)
(3) Class IIIB — any liquid that has a flash point at or above 93°C (200°F)

A.3.3.34.2 Flammable Liquid. Definition applies as determined by the test procedures and apparatus set forth in Chapter 4 of NFPA 30. Flammable liquids are further subclassified in accordance with the following:

(1) Class IA Liquid — any liquid that has a flash point below 73°F (22.8°C) and a boiling point below 100°F (37.8°C)
(2) Class IB Liquid — any liquid that has a flash point below 73°F (22.8°C) and a boiling point at or above 100°F (37.8°C)
(3) Class IC Liquid — any liquid that has a flash point at or above 73°F (22.8°C), but below 100°F (37.8°C)

•

N **A.3.3.45 Physically Separated.** Providing an airlock meeting the requirements of Section 9.4 is an acceptable method for achieving physical separation between spaces.

A.3.3.46 Pumping Station. Also called lift station.

A.3.3.51 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.3.3.60.3 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.

N **A.3.3.60.4.1 Primary Treatment with Skimming.** The intent of primary treatment with skimming is to remove floatable flammable materials.

A.3.3.66 Waste Gas Burner (flare). This text is paraphrased from MOP 8, *Design of Municipal Wastewater Treatment Plants*.

A.3.3.68.1 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.3.3.68.2 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.

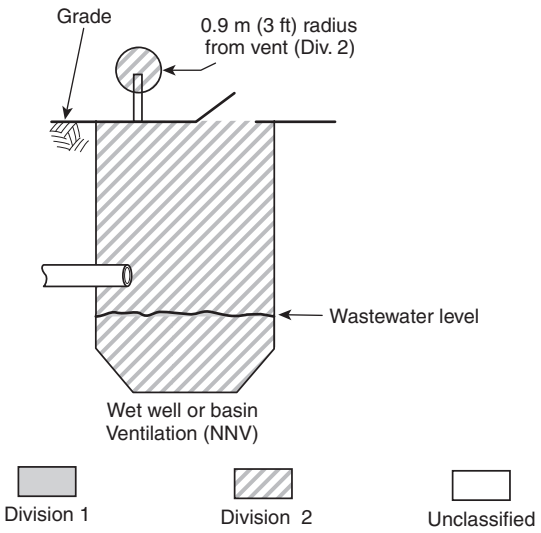
A.5.1 Additional information on sources of hazards, sources of ignition, and mitigation measures associated with liquid stream treatment processes is contained in Annex D.

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.

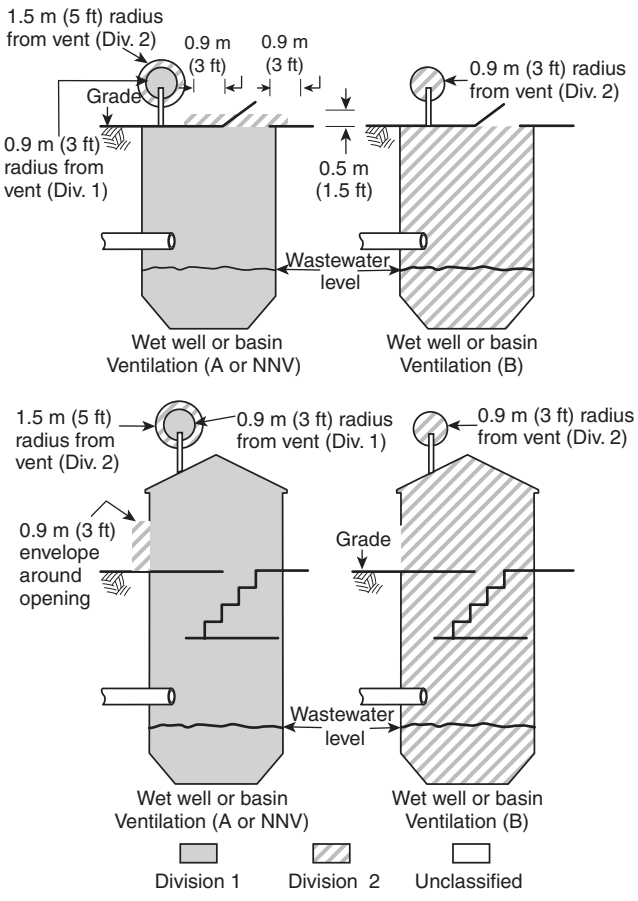
A.6.2 See Figure A.6.2(a) through Figure A.6.2(g), which provide examples for Table 6.2.2(a).

A.7.1 Additional information is contained in Annex D.



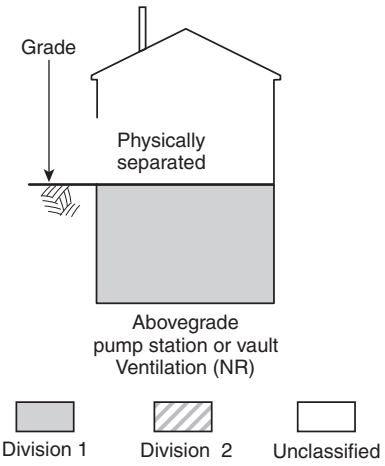
Note: Ventilation codes defined in Table 4.2.2 notes.

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



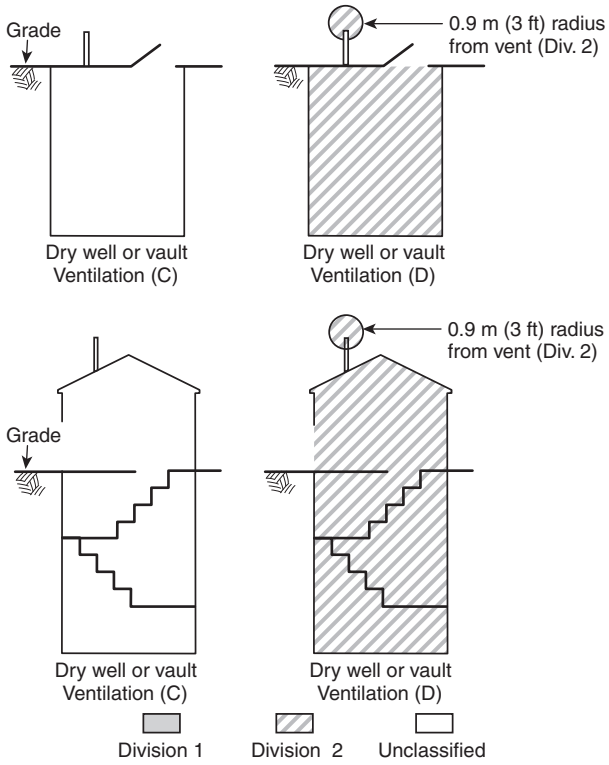
Note: Ventilation codes defined in Table 4.2.2 notes.

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.



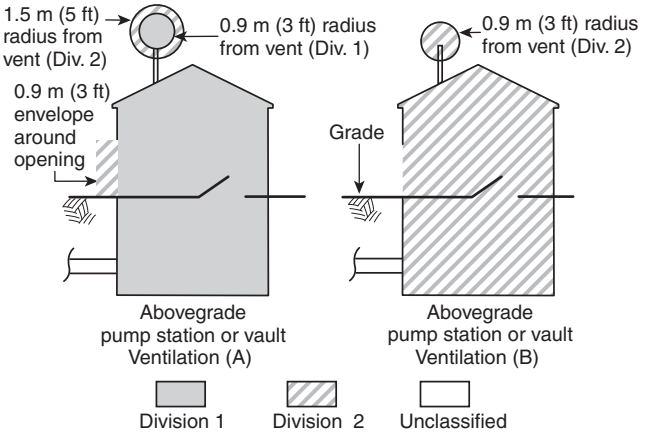
Note: Ventilation codes defined in Table 4.2.2 notes.

FIGURE A.4.2(c) Abovegrade Equipment Housing or Vault Physically Separated from Wet Well or Basin; Illustration of Table 4.2.2, Rows 16 and 28.



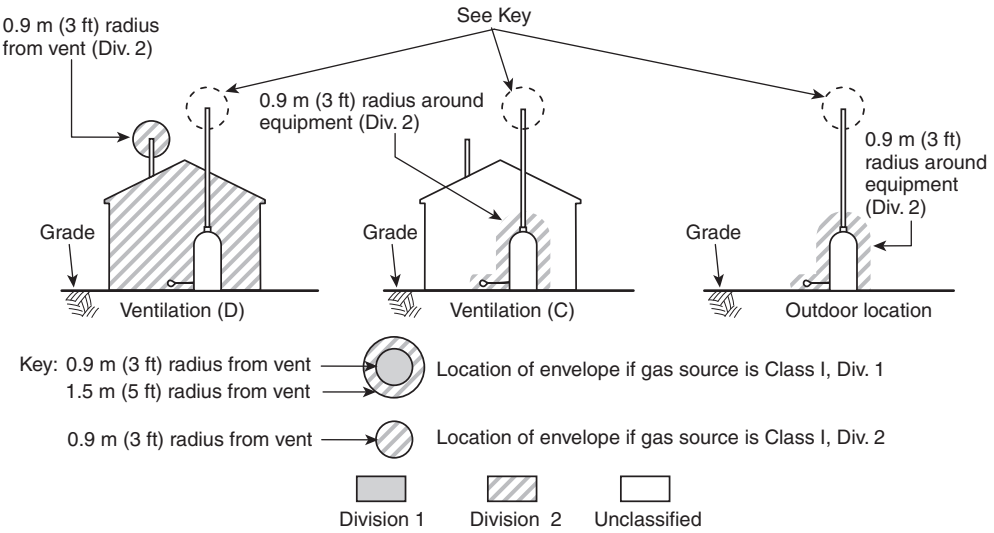
Note: Ventilation codes defined in Table 4.2.2 notes.

FIGURE A.4.2(d) Belowgrade or Partially Belowgrade Equipment Housing or Vault Physically Separated from Wet Well or Basin; Illustration of Table 4.2.2, Rows 5, 15, 29, and 34.



Note: Ventilation codes defined in Table 4.2.2 notes.

FIGURE A.4.2(e) Abovegrade Equipment Housing or Vault not Physically Separated from Wet Well or Basin; Illustration of Table 4.2.2, Row 17.



Note: Ventilation codes defined in Table 4.2.2 notes.

FIGURE A.4.2(f) Odor-Control System Location Physically Separated from Wet Well; Illustration of Table 4.2.2, Row 18.

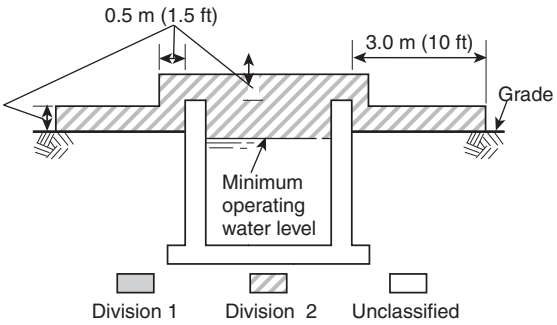


FIGURE A.5.2 Primary Sedimentation Tank; Illustration of Table 5.2.2, Row 7.

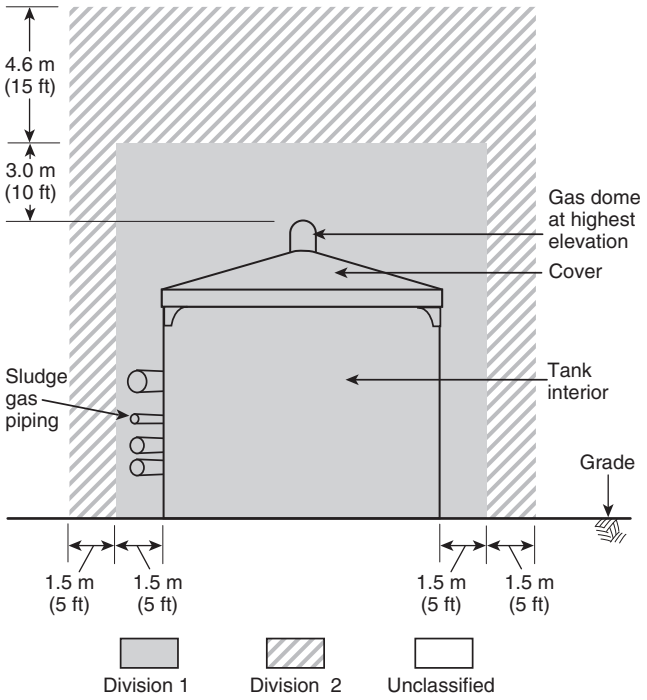


FIGURE A.6.2(a) Anaerobic Digester with Fixed or Floating Cover Above Grade Not Enclosed in a Building; Illustration of Table 6.2.2(a), Rows 16a and 16b.

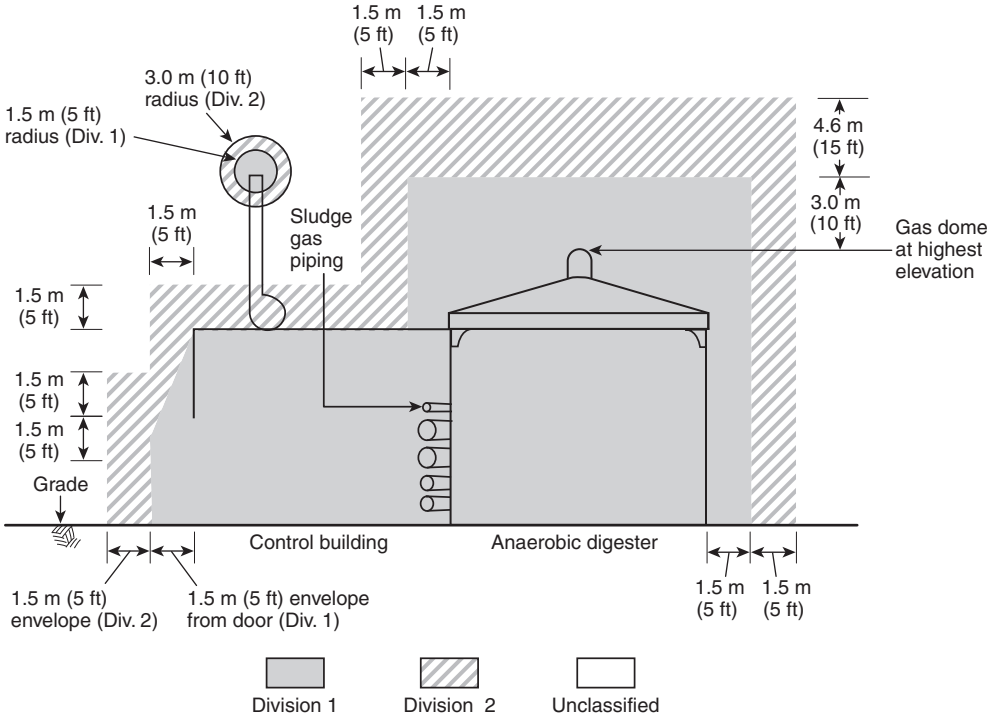


FIGURE A.6.2(b) Anaerobic Digester Control Building Containing Sludge Gas Piping and Using Ventilation Method (A); Illustration of Table 6.2.2(a), Row 17a.

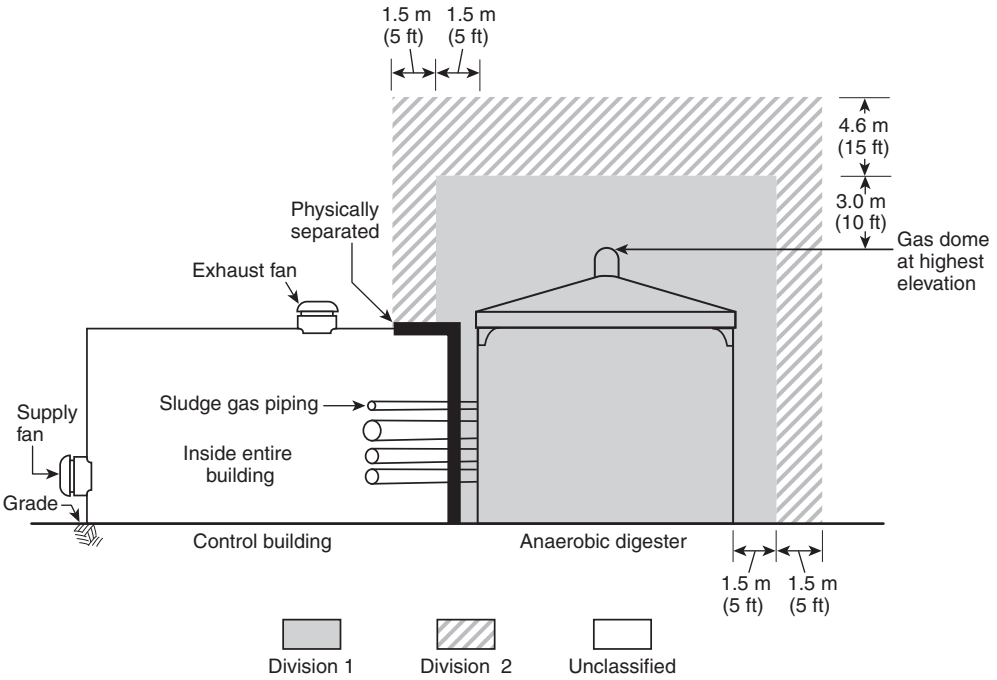
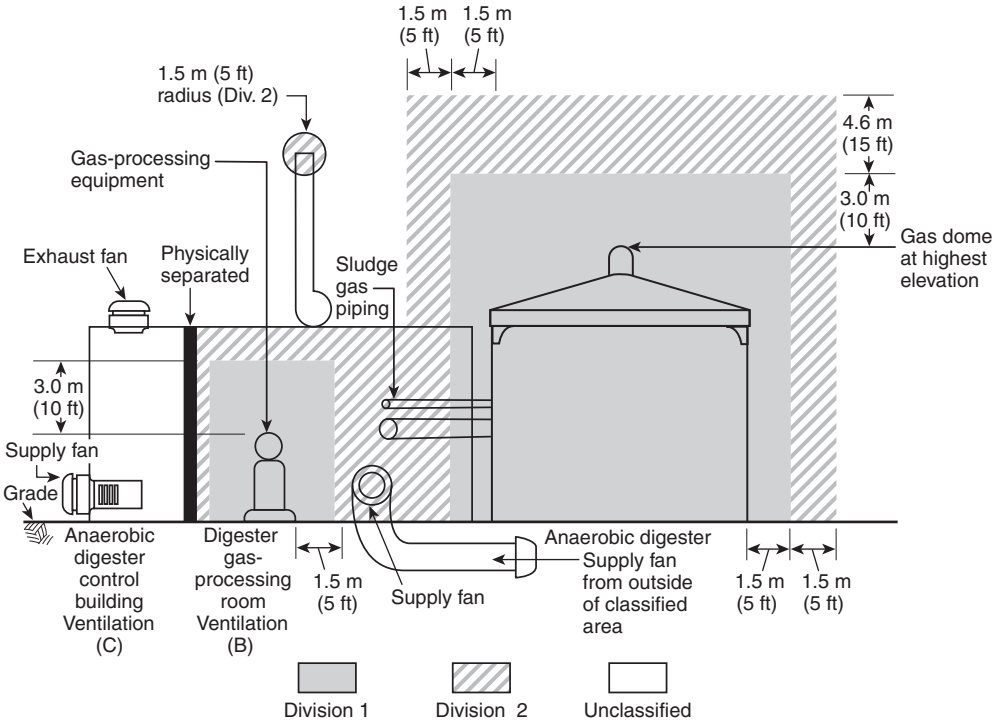


FIGURE A.6.2(c) Anaerobic Digester Control Building Containing Sludge Gas Piping and Using Ventilation Method (C); Illustration of Table 6.2.2(a), Row 17c.



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

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 17c and 18b.

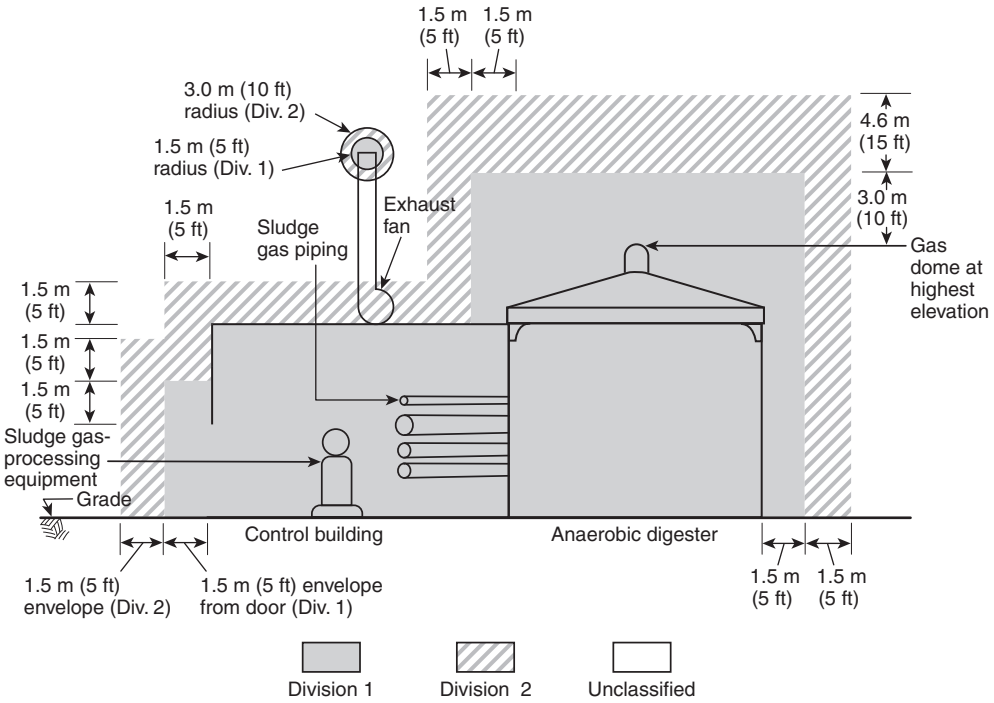


FIGURE A.6.2(e) Anaerobic Digester Control Building Containing Sludge Gas–Processing Equipment not Physically Separated and Using Ventilation Method (A); Illustration of Table 6.2.2(a), Row 17.

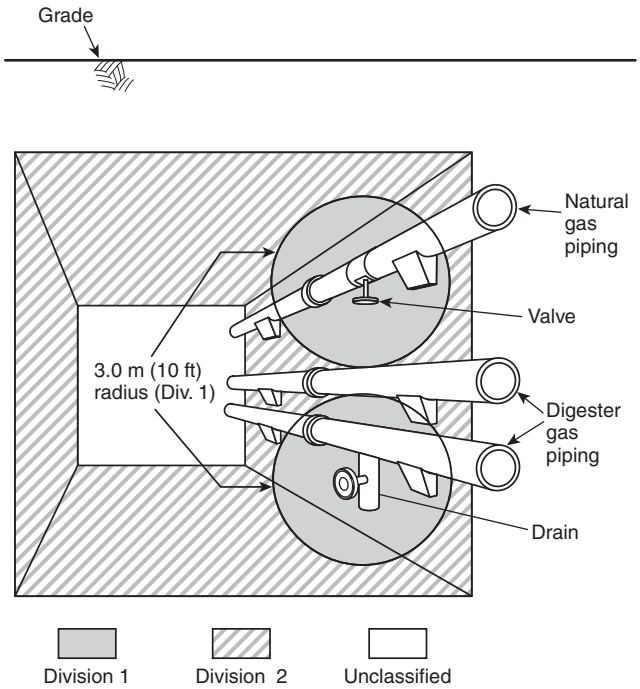


FIGURE A.6.2(f) Underground Tunnel Containing Natural Gas or Sludge Gas Piping and Using Ventilation Method (D); Illustration of Table 6.2.2(a), Rows 22a and 22b.

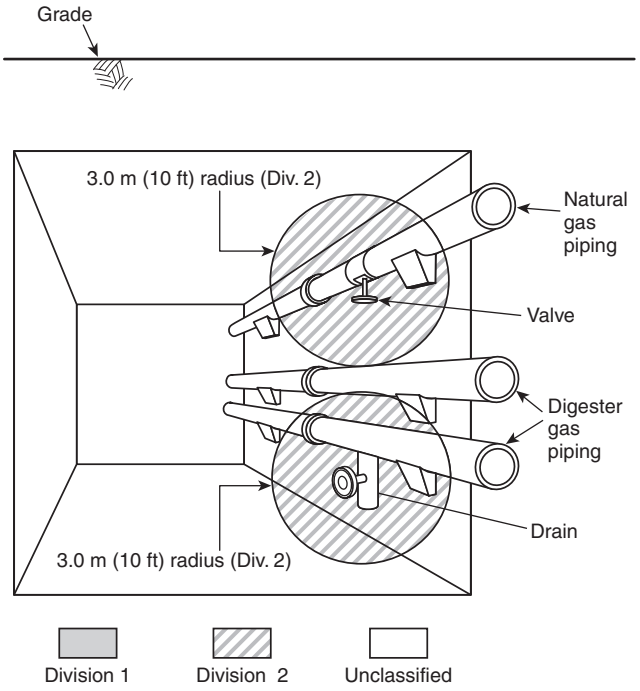


FIGURE A.6.2(g) Underground Tunnel Containing Natural Gas or Sludge Gas Piping and Using Ventilation Method (C); Illustration of Table 6.2.2(a), Rows 22c and 22d.

A.7.4.2 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.

A.7.4.3 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: For further information, see ANSI/ISA-60079-29-1 (12.13.01)-2013, *Explosive Atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable gases*, and ANSI/UL 2075, *Gas and Vapor Detectors and Sensors*. [**70:**500.7(K)]

Note: Informational Note No. 2: For further information, see ANSI/API RP 500-2012, *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division I or Division 2*. [**70:**500.7(K)]

Note: Informational Note No. 3: For further information, see ANSI/ISA-60079-29-2 (12.13.02)-2012, *Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen*. [**70:**500.7(K)]

Note: Informational Note No. 4: For further information, see ISA-TR12.13.03-2009, *Guide for Combustible Gas Detection as a Method of Protection*. [**70:**500.7(K)]

N **A.7.4.6** Infrared (IR) line-of-sight combustible gas detection sensors provide a detection level of LEL per meter (LEL-m).

A.7.6.1 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.

A.7.6.2 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.

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.

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 ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*.

A.8.2.3.2 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.8.2.3.2(1) Examples of such materials include steel, concrete, masonry, and glass.

Δ **A.8.2.3.3** 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.8.2.3.4 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 of 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 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.
(5) The total smoke released throughout the test should not exceed 1000 m^2.

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.

•

N **A.8.3.8.2** In process areas where corrosive gases or vapors are present, the equipment should be approved for use in the environment.

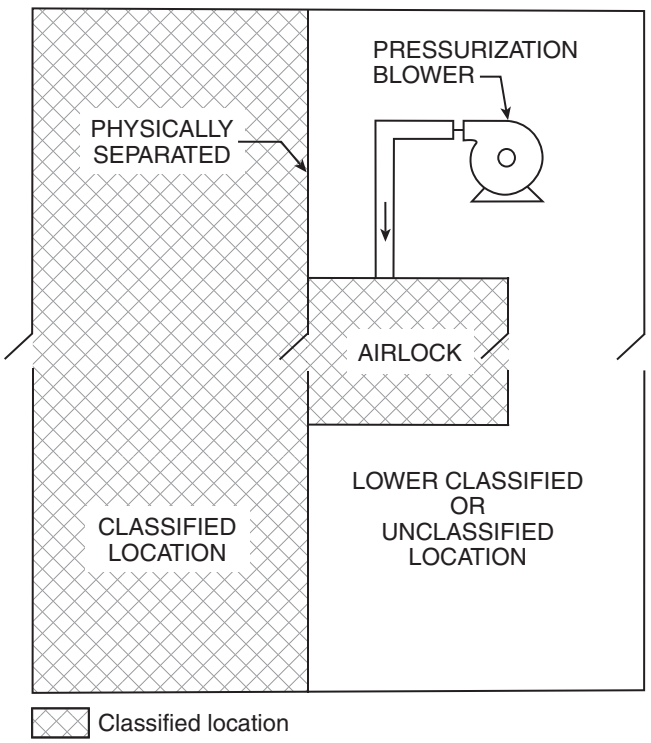
N **A.9.1.1.2** Ventilation rates and procedures established by this standard might not be sufficient to protect personnel from exposure to toxic gases that might be present in enclosed spaces. For further information, refer to NFPA 350; *Industrial Ventilation — A Manual of Recommended Practice for 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.9.4** 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.

Δ **A.10.3** The concepts included in a fire risk assessment can be found in NFPA 551.

A.10.4(7) For an example of a fire report, see Figure A.10.4(7).



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

FIRE REPORT

Name of company _____

Date of fire _____ Time of fire _____ Operating facility _____

Under construction? _____

Plant or location where fire occurred _____

Description of facility, fire area, or equipment (include nameplate rating) involved _____

_____

Cause of fire, such as probable ignition source, initial contributing fuel, equipment failure causing ignition, and so on _____

Description of fire and events and conditions preceding, during, and after the fire _____

_____

_____

_____

Types and approximate quantities of portable extinguishing equipment used _____

_____

_____

Fire extinguished with portable equipment only? _____ Public fire department called? _____

Employee fire brigade at the location? _____ Qualified for incipient fires? _____

Qualified for interior structural fires? _____

Fixed fire-extinguishing equipment installed? _____

Type of fixed extinguishing system _____

Automatic operation _____ Manually actuated _____ Both _____

Specific types of detection devices _____

Did fixed extinguishing system control fire? _____ Extinguish fire? _____ Control and extinguish fire? _____

Did detection devices and extinguishing system function properly? _____

If not, why not? _____

_____

Estimated direct damage due to fire $ _____ , or between $ _____ and $ _____

Estimated additional (consequential) loss $ _____ Nature of additional loss _____

Estimated time to complete repairs/replacement of damaged equipment/structure _____

Number of persons injured _____ Number of fatalities _____

What corrective or preventive suggestions would you offer to other utilities with similar equipment, structures, or extinguishing systems? _____

_____

Submitted by _____ Title _____

Δ **FIGURE A.10.4(7) Sample Fire Report.**

A.10.6.2 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 *Hazardous Location Equipment Directory* by Underwriters Laboratories Inc. offers guidance in maintaining and using combustible gas detectors. The following is extracted from the directory's 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.

A.10.7 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.10.9 The size of the plant and its staff, the complexity of fire-fighting problems, and the availability of a public fire department should determine the requirements for a fire brigade. The organization of a fire brigade is encouraged for wastewater treatment facilities located in remote areas.

If a fire brigade is provided, its organization and training should be identified in written procedures. The recommendations of NFPA 600 and OSHA 29 CFR 1910.156 should be consulted for additional information.

The following paragraphs discuss special fire-fighting conditions unique to wastewater facilities. This information might be useful in fire brigade training and fire preplanning.

Cable tray fires should be handled like any fire involving energized electrical equipment. It might not be practical or desirable to de-energize the cables involved in the fire. Water is the most effective extinguishing agent for cable insulation fires, but it should be applied with an electrically safe nozzle. Some cable insulations [for example, polyvinyl chloride (PVC), neoprene, or Hypalon™] can produce dense smoke in a very short time. In addition, PVC liberates hydrogen chloride (HCl) gas. Self-contained breathing apparatus should be used by personnel attempting to extinguish cable tray fires.

Some sludge-drying and sludge-composting processes (especially solvent extraction drying, sludge-drying kilns, and in-vessel composting systems) might produce a product that might be subject to spontaneous combustion. Generally, water will be the most effective fire-fighting agent in these areas. However, fires might be deep-seated in stockpiled products, which might have to be dispersed with front-end loaders or similar equipment to fully extinguish smoldering and burning material.

Some chlorinated hydrocarbon products commonly used as foam suppressants or flocculation agents in wastewater treatment might cause spontaneous combustion when in contact with powdered disinfectants. These chemicals should be stored separately, and care should be exercised in their use.

Plastic or fiberglass-reinforced plastic materials used in process units or ventilation systems might represent a considerable fuel load if ignited during operation or maintenance and might necessitate special response techniques.

A.10.9.1 NFPA 600 and OSHA 29 CFR 1910.156 should be consulted.

A.10.10 Federal regulations (40 CFR 761.30) specify that the local fire department should be notified of the location of all PCB-filled transformers and other electrical equipment.

A.10.11(1) See Chapter 9 for further information.

A.10.11(2) See NFPA 1 for further information.

A.10.11(5) See Chapter 8 for further information.

A.10.11.2.1 See Section 10.4(6) for further information.

A.10.11.3.1 See NFPA 51B for further information.

Annex B Wastewater Treatment Processes

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 General. Annex B provides a general overview and layout of the unit processes found at a typical wastewater treatment plant, although the arrangement of the unit processes varies from plant to plant. For additional information on the design and operation of wastewater treatment and collection facilities, refer to the most current *Manual of Practice (MOP)* published by the Water Environment Federation (WEF).

B.1.1 Wastewater. Wastewater is principally the spent water supply of the community. It is used to flush and transport human wastes and the liquid wastes of commerce, industry, and institutions. Groundwater, surface water, and storm water might also be present. The primary purposes of wastewater treatment are to protect the health and well-being of the community and the quality of the receiving waterway. The extent or completeness of wastewater treatment to accomplish these purposes is governed by legislation and regulations and will vary from jurisdiction to jurisdiction.

B.1.2 Elements of Wastewater Treatment. The principal elements of wastewater treatment are as follows:

(1) Preliminary treatment
(2) Primary treatment with skimming
(3) Secondary treatment
(4) Tertiary treatment
(5) Disinfection
(6) Sludge treatment

A typical schematic flow and process diagram for a wastewater treatment plant is shown in Figure B.1.2.

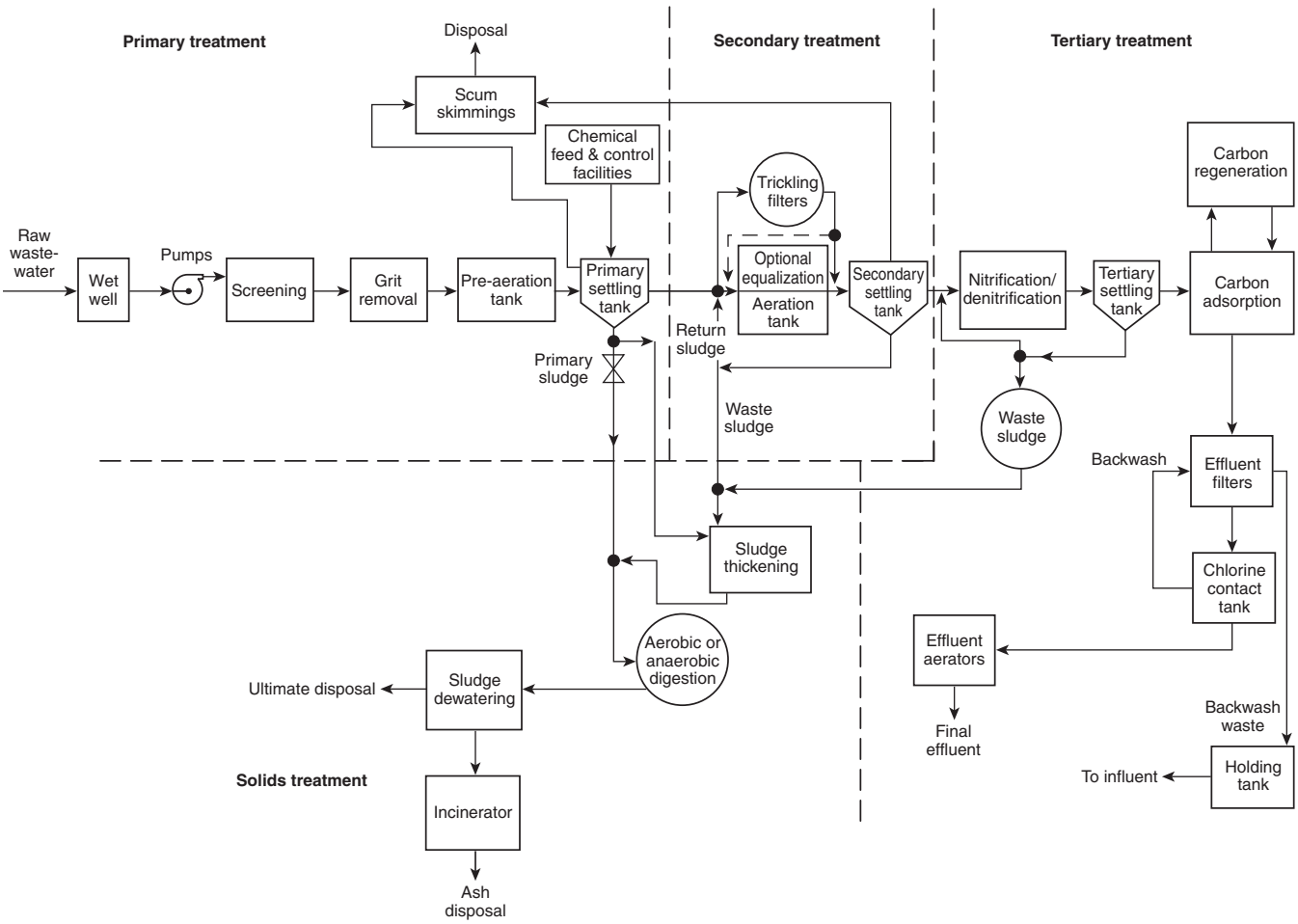


FIGURE B.1.2 Typical Schematic Flow and Process Diagram of a Wastewater Treatment Plant.

B.2 Preliminary Treatment. Preliminary treatment is the conditioning of wastewater as it enters the wastewater treatment plant. Preliminary treatment removes materials that might be harmful to or might adversely affect the operation of the treatment plant. Such material might include lumber, cardboard, rags, stones, sand, plastic, grease, and scum. The methods and equipment used to remove these materials include bar racks, bar screens, and gravity or aerated grit chambers.

B.3 Primary Treatment with Skimming. Primary treatment with skimming is first-stage sedimentation, in which settleable, suspended, and floating material is removed from the wastewater following preliminary treatment. Well-operated primary treatment with skimming facilities can remove as much as 60 percent of the influent suspended solids and 30 percent of the influent biochemical oxygen demand. However, primary treatment with skimming does not remove colloidal or dissolved solids.

B.4 Secondary Treatment. Secondary treatment is intended to reduce the concentrations of the remaining suspended solids and the dissolved and colloidal organic matter in the wastewater. Such material is not removed to any significant degree in primary treatment with skimming. A wastewater treatment plant having secondary treatment following primary treatment with skimming commonly can achieve removal of a total of 90 percent of the influent suspended solids and biochemical oxygen demand of the raw wastewater. Secondary treatment processes can be either biological or physical–chemical.

B.4.1 Biological Treatment. Most municipal secondary treatment processes are biological. These processes can be classified as fixed film or suspended growth. In each process, a mixed population of microorganisms is established in the presence of oxygen. These microorganisms metabolize the dissolved organic matter in the wastewater and form a biological mass. The effluent from fixed film or suspended growth processes contains suspensions of biological solids. These solids are removed from the treated wastewater in a secondary sedimentation tank.

B.4.2 Physical–Chemical Treatment. Physical–chemical treatment includes one or more physical–chemical unit processes to treat primary effluent. Such processes might include chemical coagulation, precipitation, and filtration to remove suspended matter and activated carbon adsorption to remove soluble organics.

B.5 Tertiary Treatment. Tertiary treatment is used as necessary to reduce the concentration of inorganic and organic constituents below the concentrations achievable through secondary treatment. Tertiary treatment also includes the

removal of nitrogen and phosphorus by additional process unit operations. Tertiary treatment processes can be physical, chemical, biological, or a combination.

B.6 Disinfection. Disinfection is necessary to destroy pathogenic bacteria, viruses, and amoebic cysts commonly found in wastewater. Disinfection processes can be chemical, such as ozonation or chlorination, or physical, such as ultraviolet irradiation. Chemical disinfection using chlorine and, infrequently, ozone are the most widely used means of wastewater disinfection.

B.7 Sludge Treatment.

B.7.1 Sludge Stabilization. Sludge is the settled solids accumulated and subsequently separated from the liquid during various wastewater treatment processes. Sludge handling and disposal is the most difficult, important, and costly part of the wastewater treatment process. Sludge treatment typically consists of stabilization followed by dewatering prior to disposal. Sludge can be stabilized under either anaerobic or aerobic conditions. Anaerobic sludge digestion takes place in the absence of free oxygen. The solid end product of anaerobic digestion is relatively nonputrescible and inoffensive. The offgas produced in anaerobic sludge digestion contains about 65 percent methane and can be collected and burned as a fuel.

B.7.2 Sludge Dewatering. Both anaerobic and aerobic digestion result in a reduction in the total volume and weight of the excess organic matter. It is often desirable, before final disposal, to reduce the volume and weight of sludge further and to change it from a liquid that is more than 95 percent water to a semisolid form. Dewatering can be accomplished by using drying beds, vacuum filters, centrifuges, filter presses, or mechanical gravity units. The dewatering operation often is enhanced by chemically conditioning the sludge before dewatering. The conditioning can include a thickening step that can be gravity or air flotation. Thermal conditioning can also be used to prepare sludge for dewatering.

B.7.3 Sludge Cake Disposal. After sludge has been dewatered, it is identified as sludge cake. This material is disposed of by several different methods. It can be incinerated to reduce the volume to ash — approximately 10 percent of the original cake. The heat of this combustion can be utilized to produce steam for process and building heat. The cake can be composted to produce a soil conditioner. Cake can be spread directly on land for agricultural use, or it can be landfilled as a waste material.

Annex C Selection of Collection System Materials

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 General. Wastewater collection systems might or might not be vulnerable to the introduction of flammable liquids into the wastewater. These liquids, if lighter than water, will float and collect on the surface. The presence of these materials can present a threat to the integrity of the collection system should ignition occur.

C.2 Materials of Construction.

C.2.1 Some materials commonly used in sewer construction are vulnerable to attack from environmental conditions commonly found in collection systems but might provide resistance to damage from fire. Other materials might be vulnerable to structural damage from fire but provide protection against long-term structural failure from corrosion.

C.2.2 For additional information on corrosion control, see National Association of Corrosion Engineers Recommended Practices RP01 series and the applicable Water Environment Federation publications.

C.3 Materials Risk Assessment.

C.3.1 The materials risk assessment should include an evaluation of all factors that could potentially affect the safety and long-term functioning of the collection system. Factors to be considered should include both of the following:

(1) The potential that flammable liquids can enter the system from identifiable sources. An example is a system serving a combined system or a system serving commercial and industrial dischargers that might be more vulnerable to exposure to floating flammable materials than separate systems serving residential communities.
(2) The potential for the development of conditions that might promote attack to materials vulnerable to corrosive agents. Experience with existing conditions within the community and with existing systems with similar characteristics should be taken into full account when evaluating this factor.

C.3.2 Before the final selection of materials is made, the materials risk assessment should consider the long-term threat that flammable, corrosive, and explosive agents present to the community and to the system's ability to serve the community. It is recommended that the materials risk assessment be presented to local authorities for review and comment before the final selection of materials of construction is completed.

C.4 Examples.

C.4.1 Storm sewers serving locations such as residential areas and areas where significant quantities of flammable or combustible materials are not expected to enter the sewer system, sewers, and appurtenant structures could be constructed of any appropriate material.

C.4.2 Storm sewers serving locations such as commercial and industrial areas or areas where there is a possibility that significant quantities of flammable or combustible materials could enter the sewer system through illicit discharges, curb inlets, leaking underground storage tanks, or broken pipes, sewers, and associated structures might be exposed to considerable risk of fire. Materials meeting the definitions of noncombustible, limited-combustible, or low flame spread index might be appropriate.

C.4.3 Where conditions or applications warrant selection of other materials for storm sewer piping and appurtenant structures, consideration of flame spread, smoke generation, and the impact that fire or explosion will have on the structural integrity and operability of the sewer system and the economic and environmental consequences of having the sewer system out of service should be included in the materials risk assessment.

C.4.4 Separate sanitary sewers serving locations such as residential areas and areas where significant quantities of flammable or combustible materials are not expected to enter the sewer system, sewers, and appurtenant structures can be constructed of any appropriate material.

C.4.5 Separate sanitary sewers serving locations such as commercial and industrial areas or areas where there is some possibility that significant quantities of flammable or combustible materials could enter the sewer system from illicit discharges, leaking underground storage tanks, or broken pipes, sewers, and appurtenant structures might be exposed to some risk of fire. Materials meeting the definitions of noncombustible, limited-combustible, or low flame spread index might be appropriate.

C.4.6 Where applications warrant selection of other materials for separate sanitary sewer piping and appurtenant structures, consideration of flame spread, smoke generation, and the impact that a fire or explosion will have on the structural integrity and operability of the sewer system and the economic and environmental consequences of having the sewer system out of service should be included in the materials risk assessment.

C.4.7 Where combined sewers are designed to collect both wastewater and storm water, or where there is a possibility that significant quantities of flammable or combustible materials could enter the sewer system by means of curb inlets, illicit discharges, leaking underground storage tanks, or broken pipes, all sewers and other appurtenant structures can be exposed to considerable risk of fire. Materials meeting the definitions of noncombustible, limited-combustible, or low flame spread index might be appropriate.

C.4.8 Where conditions or applications warrant selection of other materials for combined sewer piping and appurtenant structures, consideration of flame spread, smoke generation, and the impact that a fire or explosion will have on the structural integrity and operability of the sewer system and the economic and environmental consequences of having the sewer system out of service should be included in the materials risk assessment.

Annex D Chemical and Fuel Fire/Explosion Hazards

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

D.1 General Information.

D.1.1 This annex provides guidelines for protection against fire and explosion in the chemical- and fuel-handling and storage facilities. This annex does not include gas utilization equipment, vehicle maintenance areas, or laboratories. Table D.1.1 summarizes the various hazards associated with chemical- and fuel-handling and storage facilities.

D.1.2 This annex also contains additional information on specific areas or unit operations associated with the storage and handling of chemicals and fuels commonly used in municipal wastewater treatment plants.

D.2 Sources of Hazards. See Table D.2 for hazard sources and physical properties.

D.2.1 Fuel Gases. Fuel gases include natural gas, manufactured gas, sewer gas, liquefied petroleum gas–air mixtures, liquefied petroleum gas in the vapor phase, mixtures of these gases, and floating flammable liquids. Some of these gases have specific gravities lower than that of air so that, when released, they will rapidly rise and diffuse above the point of leakage. Flammable mixtures are produced when these gases are mixed with air within certain limits. These mixtures can be considered suffocating gases.

D.2.2 Sludge Gases. Sludge gases are flammable gases that result from the fermentation or anaerobic decomposition of organic matter. Explosive conditions, especially concerning compression and storage, can result when these gases are mixed with air.

D.2.3 Sewer Gases. Sewer gases are flammable gases that result from the fermentation or decomposition of organic matter. Explosive conditions, especially concerning the screening, degritting, and primary clarification processes, might result when these gases are mixed with air.

D.2.4 Unit Processes. Special consideration should be given to items specified in D.2.4.1 through D.2.4.14, which are processes associated with solids treatment.

D.2.4.1 Scum pits collect scum, grease, and other floating flammable liquids from the surface of sedimentation tanks. Special consideration should be given to equipment located in these areas because of potential explosion and fire hazards.

D.2.4.2 Sumps and tanks that collect drainage from anaerobic sludge treatment processes or that store, mix, and blend sludge might also collect significant volumes of sludge gas. Special consideration should be given to equipment located in these areas because of the potential for explosion.

D.2.4.3 Anaerobic digesters are unit processes specifically designed to produce sludge gas from the fermentation or anaerobic decomposition of organic matter. The sludge gas normally contains significant volumes of methane as a by-product of the anaerobic digestion process. Special consideration should be given to equipment located in and around anaerobic digesters because of the potential for explosion.

D.2.4.4 Solvent extraction and dehydration processes can produce a very dry organic dust as a by-product. Special consideration should be given to equipment located in dust-handling areas because of the potential for explosion.

D.2.4.5 Incinerators used to burn scum or sludge cake are ignition sources when in operation. Special consideration should be given to construction of incineration buildings and to storage of combustible materials in incineration areas.

D.2.4.6 Sludge-dewatering and sludge-cake conveyance equipment generate sludge cake and convey it to its final destination (e.g., incineration, landfill). Dried cake can be a combustible material. Special consideration should be given to construction, operation, maintenance, and housekeeping of the equipment and surrounding areas.

D.2.4.7 Pumping stations that handle raw wastewater should be classified in the same manner as wastewater pumping stations *(see Chapter 4)*. In-plant pumping stations should be classified on the basis of their location in the process train and the type of material handled. Restrictive classifications are generally not necessary for pumping stations that handle fully treated wastewater.

D.2.4.8 Grit chambers or screening equipment that is housed in a building or in belowgrade pits might be subject to the same fire and explosion hazards as pumping station wet wells.

D.2.4.9 Imhoff tanks and other similar processes can combine the wastewater liquids and solids treatment streams in a single vessel. Special consideration should be given to equipment located in or around Imhoff tanks or similar processes because of the generation of methane gas from anaerobic solids diges-

Δ Table D.1.1 Chemical and Fuel Fire/Explosion Hazards

Materials and Function	Fire and Explosion Hazard	Ventilation	Extent of Classified Location	*NEC* Hazardous Location Classification (All Class I, Group D)	Material of Construction for Buildings or Structures	Fire Protection Measures
ALCOHOL Used in some tertiary treatment	Flammable vapors	See NFPA 30				
CHLORINE (Gas) Chlorination of water	Aids combustion; oxidizer, toxic	NR	NR	Refer to Chlorine Institute	NR (This equipment handles a corrosive chemical that necessitates the use of specific materials of construction. Special consideration should be given to these materials of construction.)	NR
OXYGEN Used in aeration basins *(See Chapter 3.)*	Aids combustion; oxidizer	See NFPA 55			NR	NR
DIESEL FUEL, GASOLINE, AND MOTOR OILS Fuels for equipment	Various	See NFPA 30			NR	Indoors, FSS and FE; outdoors, FE
LIQUEFIED PETROLEUM GAS	Flammable gas	NR (stored outdoors)		See NFPA 58	NR	FE
OXYGEN GENERATION AND STORAGE	Aids combustion; oxidizer, oxygen-enriched areas	See NFPA 53 and NFPA 55			NR	FSS (if indoors), H, and FE
OZONE GENERATION	Aids combustion; oxidizer, toxic	See NFPA 53 and NFPA 55			NR	FSS (if indoors), H, and FE
ACTIVATED CARBON (powdered or pulverized)	Combustible	NR	NR	NR	NR	NR

Note: The following codes are used in this table:
FE: Portable fire extinguisher.
FSS: Fire suppression system (e.g., automatic sprinkler, water spray, foam, gaseous, or dry chemical).
H: Hydrant protection *(see 7.2.4)*.
NEC: See *NFPA 70*.
NR: No requirement.

tion processes within the vessel and the possibility of volatile substances being released from the wastewater.

D.2.4.10 The primary sedimentation tank might collect and concentrate floating flammable liquids.

D.2.4.11 Secondary and tertiary sedimentation tanks and aeration tanks not preceded by primary sedimentation can be subject to the same fire and explosion hazards as primary sedimentation tanks because of the potential of floating flammable liquids collecting on the surface. Where bypassing of primary sedimentation is possible, although not normally utilized, secondary and tertiary sedimentation tanks and aeration tanks might not be subject to the same fire and explosion potential as primary sedimentation.

D.2.4.12 Unit processes employing oxygen-enriched atmospheres necessitate special consideration. Covered facilities might be unclassified above the covering deck. However, any equipment or instrumentation housed under the cover within the reactor space should be suitable for exposure to volatile liquids in an oxygen-enriched atmosphere. Oxygen itself is not flammable. However, increased concentrations of oxygen greatly increase the fire hazard. Oxygen aeration tanks and other similar processes should be equipped with continuously operating hydrocarbon LFL monitoring devices that will automatically cut off the oxygen supply and purge reactor gases with atmospheric air when 25 percent LFL conditions are registered. With the exception of purging equipment, all associated aeration equipment should automatically shut off when 50 percent LFL conditions are registered to remove all possible sources of ignition.

Table D.2 Gases Commonly Found in Wastewater Treatment

Name (Chemical Formula)	Flammable Limits (% vol) LFL	Flammability	UFL	Density[a] Heavier/Lighter Than Air	Sources
Ammonia[b] (NH_3)	15		28	L	Storage tank leaks
Chlorine[c] (Cl_2)		Nonflammable		H	Disinfection processes Storage tanks
Gasoline[b] (C_5H_{12} – C_9H_{20})	1.4		7.6	H	Storage tanks Tank truck spills
Hydrogen chloride (HCl)		Nonflammable		H	Storage tank leaks Ceramic diffuser cleaning
Hydrogen sulfide[b,d] (H_2S)	4.0		44.0	H	Sewer gas Sludge gas
Natural gas[b]	3.8–6.5		13–17	L	Gas-piping leaks
Nitrogen (N_2)		Nonflammable		L	Storage tanks Oxygen generation processes Denitrification processes
Oxygen[c] (O_2)		Nonflammable		H	Generation of oxygen on site Activated sludge processes Storage tanks Sludge processes
Ozone[c] (O_3)		Nonflammable		H	Disinfection processes On-site generation processes
Sewer gas[e]	5.3		19.3	H	Sewer systems
Sludge gas[f]	5		15	L	Sludge digestion processes
Sulfur dioxide (SO_2)		Nonflammable		H	Dechlorination processes Storage tanks

[a]The table lists the physical properties at standard temperature and pressure. Due to actual field conditions, these gases might disperse and might be present throughout the structure.
[b]Source: *Fire Protection Guide to Hazardous Materials.*
[c]These gases accelerate combustion.
[d]Rarely reaches explosive concentration in wastewater treatment plants.
[e]Contains approximately 70 percent carbon dioxide, 5 percent methane, and 25 percent other gases. *(Source: U.S. EPA.)*
[f]Contains approximately 65 percent methane, 30 percent carbon dioxide, and 5 percent other gases. *(Source: U.S. EPA.)*

D.2.4.13 Galleries and other connecting structures that contain pipes transporting flammable gases or liquids necessitate special consideration in design and fire protection.

D.2.4.14 Plastic media or wood for trickling filters, rotating biological contactors, bio-towers, and other fixed-film systems are not a significant hazard in normal operations. However, these materials are normally classified as combustible and can contribute a considerable fuel load if ignited under certain conditions, such as during maintenance and construction. Some fixed-film treatment systems are anaerobic and produce a combustible gas by-product, which aggravates the hazard to such enclosures containing these materials.

D.2.5 Chemicals. Wastewater treatment plants use a variety of gaseous, solid, and liquid chemicals that by themselves or when mixed with oxygen or other chemicals can be a potential source of fire, explosion, or both. Additional information can be found in the following documents:

(1) NFPA 45
(2) *Fire Protection Guide to Hazardous Materials*
(3) NFPA 497
(4) NFPA 499

Chemicals should be handled, processed, and stored in a manner that eliminates or significantly reduces the hazard to the wastewater treatment facility and personnel and is acceptable to the authority having jurisdiction. Chemicals should be properly labeled to identify the materials and hazards, and materials safety data sheets should be made available to all personnel.

D.2.6 Hazardous Gases. Sewer and sludge gases are flammable gases generated by the fermentation or decomposition of organic matter. Explosive conditions, especially concerning screening, degritting, primary clarification, and the anaerobic digestion process, can result when these gases are mixed with air. Specialty gases utilized for the following can form flammable/explosive conditions when either acting alone or mixed with other gaseous organic substances:

(1) Laboratory analysis and instrumentation calibration (hydrogen, methane, etc.)
(2) Wastewater treatment plant unit processes (chlorine, ozone, etc.)
(3) Welding operations (acetylene, oxygen, etc.)

Fuel gases, including natural gas, manufactured gas, and liquefied petroleum gas, used as fuels for wastewater treatment plant equipment can cause flammable/explosive conditions when improperly used, handled, or stored. Appropriate measures should be taken to prevent the accumulation of hazardous gases, including ventilation, proper storage, and safe handling/

distribution systems. For additional guidance, see NFPA 55 and NFPA 59A. In processes where explosive mixtures cannot be prevented, explosion venting or protection systems should be provided. See NFPA 68 and NFPA 69 for additional guidance.

Δ **D.2.7 Liquids.** The disposal of waste chemical products through sewers and into wastewater treatment plants, and the disposal of waste chemical products and scum skimmed from sedimentation tanks, can be potential sources or contributing causes of fire and explosive conditions. Hydrocarbon liquids such as gasoline, kerosene, oils, and various chemicals either sent to sewers and drains or used for various applications at wastewater treatment plants can also provide flammable vapor concentrations at certain locations. For additional information, see NFPA 30 and NFPA 329. Areas of wastewater treatment plants as identified and classified in Table 4.2.2, Table 5.2.2, Table 6.2.2(a), and Table 6.2.2(b), especially areas of primary treatment with skimming, should be protected as flammable liquid hazards.

D.2.8 Finely Divided Solids and Dusts. Finely divided solids used in various wastewater treatment processes, especially sludge dehydration processing, or dust by-products produced by such processes can be combustible or cause potential flammable and explosive conditions. Process areas should be cleaned on a regular schedule to prevent the accumulation of hazardous concentrations of dust. Equipment handling finely divided solids should be designed and installed in a manner that protects against the hazards of fire and explosion. Additional information can be found in NFPA 61, NFPA 91, and NFPA 85.

D.2.9 Materials. Certain materials used in wastewater treatment plants because of humid or corrosive atmospheres, including wood, plastic, fiberglass-reinforced plastics (FRPs), paints and coatings, insulating material, and furnishings, can be combustible, limited-combustible, or low flame spread index under certain conditions. Some of these materials can present a considerable fuel load if ignited. Buildings and structures should be provided with fire protection in accordance with Chapter 8. Areas where materials are stored should be provided with appropriate fire protection approved by the authority having jurisdiction. For additional guidance, see NFPA 1 and NFPA 13.

D.3 Conditions for and Sources of Ignition. The potential ignition of flammable gases, liquids, and solids, including dusts, that can be found at a wastewater treatment plant is limited by certain fundamental conditions. Gases and generated vapors need to be mixed with air or an oxidizer to form a flammable mixture that needs heat of sufficient intensity for ignition. The ignition temperature of a combustible solid is influenced by the rates of airflow and heating as well as the geometry of the rates of airflow and heating and the geometry of the solid. Ignition can result from one or more of the following causes:

(1) Open flames or hot surfaces
(2) Electrical arc
(3) Sparks
(4) Chemical reaction

Δ **D.3.1 Open Flames and Hot Surfaces.** Open flames and hot surfaces might be encountered during normal operation, repair and maintenance operations, or with malfunctioning equipment and appliances within a wastewater treatment plant. Sources of ignition might include welding tasks, boilers, incinerators, kerosene-type lanterns, internal combustion engines, and smoking by personnel. Equipment producing open flames or hot surfaces capable of producing ignition should be properly installed, maintained, and isolated from potential hazards. For additional guidance, see the following:

(1) NFPA 31
(2) NFPA 37
(3) NFPA 82
(4) NFPA 85

Smoking should be prohibited in all hazardous locations.

D.3.2 Electrical Arc. Sustained arcing faults can cause extensive damage to electrical switchgear and motor control centers. This arcing might provide sufficient heat to ignite flammable gases or vapors present or generated as a result of the arc (e.g., pyrolysis of insulating material). Electrical equipment should be properly maintained in good operating condition. Faulty equipment should be removed from service. See NFPA 70B for additional guidance.

D.3.3 Sparks. Sparks generated by the following can be a source of ignition for gases of flammable vapors:

(1) Defective or worn electrical and mechanical equipment
(2) Activities performed by personnel
(3) Static electricity

Fire prevention practices to eliminate or control this hazard should include a preventive maintenance program, the use of nonsparking tools, and the provision of bonding and grounding conductors in hazardous locations. See NFPA 77 for additional guidance.

D.3.4 Chemical Reaction. Fire and explosion can be the result of the chemical reaction of the following:

(1) Substances introduced in the wastewater treatment plant influent
(2) Substances used for laboratory analysis
(3) Substances necessary to various unit processes
(4) Substances produced as by-products

Potential chemical reactions can cause hazardous conditions that range in severity from the generation of flames (i.e., spontaneous combustion) to explosion. Chemicals should be identified and stored in a proper manner. Noncompatible chemical combinations should be identified, and segregated storage should be provided. See *Fire Protection Guide to Hazardous Materials* for additional information.

D.4 Mitigation Measures. Mitigation of either hazards or potential ignition sources is achieved with a commonly preferred method of copious flushing with air (i.e., ventilation). In the event that a foreign combustible material enters the sewer system, removal by vacuum or coverage with foam might become necessary. Whenever possible, such entry is to be avoided by containment and adsorption. Appropriate use of a combustible gas detector is warranted as a minimal precaution preceding personnel entry into a collection system. The presence of toxic gases should be considered when personnel enter any confined space.

D.4.1 Physical Mitigation Measurers. Special consideration should be made in the design, construction, and operation of the wastewater treatment plant to mitigate the risk and minimize the damage to the physical structures from fire and/or explosion caused by accidental or intentional events. Additional information on providing physical security can be found

in *Guidelines for the Physical Security of Wastewater/Stormwater Utilities* (ANSI/ASCE/EWRI 57-10), published jointly by the American Society of Civil Engineers, American National Standards Institute, and the Environmental and Water Resources Institute.

In addition, there are other tools to help the wastewater utility assess vulnerability and evaluate mitigation measures to reduce the risk and/or minimize the damage to the physical structures from fire and/or explosion. Information on the Vulnerability Self Assessment Tool (VSAT) is available from the Environmental Protection Agency at http://water.epa.gov/infrastructure/watersecurity/techtools/vsat.cfm.

D.5 Storage and Production Facilities. Special consideration should be given to the following facilities associated with the storage and production of chemicals and fuels used in the treatment of municipal wastewater.

D.5.1 Oxygen generation, storage, and handling facilities necessitate special consideration. Although oxygen is not itself flammable, it does support combustion, and increased concentration of oxygen greatly increases the fire hazard. See NFPA 55.

D.5.2 Ozone is generated by passing oxygen through an electric field. As with oxygen-generating facilities, there is an increased fire hazard. Ozonation facilities necessitate special consideration because of the extreme heat and electric field generated and the additional concern for the extreme corrosivity and toxicity of ozone. See NFPA 55.

D.5.3 Chlorine is a very reactive chemical and necessitates special consideration in storing and handling. Chlorine in combination with other chemicals can produce sufficient heat to cause combustion of flammable materials. Chlorine and other reactive chemicals should always be stored separately. *(See Pamphlet 155, Water and Wastewater Operators Chlorine Handbook; and Pamphlet 164, Reactivity and Compatibility of Chlorine and Sodium Hydroxide with Various Materials, published by the Chlorine Institute.)*

D.5.4 Activated carbon stored in bulk or in bags can provide a source of combustible material that can add a considerable fuel load if ignited. Special consideration should be given to equipment located in activated carbon-handling areas or activated carbon storage facilities because of the potential for fire.

Annex E Informational References

E.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

Δ **E.1.1 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2018 edition.

NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 2016 edition.

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 2018 edition.

NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*, 2019 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2019 edition.

NFPA 53, *Recommended Practice on Materials, Equipment, and Systems Used in Oxygen-Enriched Atmospheres*, 2016 edition.

NFPA 54, *National Fuel Gas Code*, 2018 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2020 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2020 edition.

NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)*, 2019 edition.

NFPA 61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities*, 2017 edition.

NFPA 68, *Standard on Explosion Protection by Deflagration Venting*, 2018 edition.

NFPA 69, *Standard on Explosion Prevention Systems*, 2019 edition.

NFPA 70®, *National Electrical Code®*, 2020 edition.

NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*, 2019 edition.

NFPA 72®, *National Fire Alarm and Signaling Code*, 2019 edition.

NFPA 77, *Recommended Practice on Static Electricity*, 2019 edition.

NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment*, 2019 edition.

NFPA 85, *Boiler and Combustion Systems Hazards Code*, 2019 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids*, 2015 edition.

NFPA 220, *Standard on Types of Building Construction*, 2018 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 2018 edition.

NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*, 2018 edition.

NFPA 329, *Recommended Practice for Handling Releases of Flammable and Combustible Liquids and Gases*, 2015 edition.

NFPA 350, *Guide for Safe Confined Space Entry and Work*, 2019 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*, 2017 edition.

NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas,* 2017 edition.

NFPA 551, *Guide for the Evaluation of Fire Risk Assessments,* 2019 edition.

NFPA 600, *Standard on Facility Fire Brigades,* 2015 edition.

NFPA 5000®, Building Construction and Safety Code®, 2018 edition.

Fire Protection Guide to Hazardous Materials, 2010 edition.

E.1.2 Other Publications.

E.1.2.1 ACGIH Publications. American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Drive, Cincinnati, OH 45240-1634.

Industrial Ventilation — A Manual of Recommended Practice for Design, 28th edition, 2013.

E.1.2.2 API Publications. American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

ANSI/API RP 500, *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Division 1 and Division 2*, 3rd edition, 2012.

E.1.2.3 ASCE Publications. American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400.

ANSI/ASCE/EWRI 57-10, *Guidelines for the Physical Security of Wastewater/Stormwater Utilities*, 2011.

E.1.2.4 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2018.

E.1.2.5 CI Publications. The Chlorine Institute, 342 Madison Avenue, New York, NY 10017.

Pamphlet 155, Water and Wastewater Operators Chlorine Handbook, Edition 3, 2014.

Pamphlet 164, Reactivity and Compatibility of Chlorine and Sodium Hydroxide with Various Materials, Edition 3, 2017.

E.1.2.6 EPA Publications. Environmental Protection Agency, William Jefferson Clinton East Building, 1200 Pennsylvania Avenue, NW, Washington, DC 20460.

Vulnerability Self Assessment Tool (VSAT).

E.1.2.7 ISA Publications. International Society of Automation, 67 T. W. Alexander Drive, PO Box 12277, Research Triangle Park, NC 27709.

ANSI/ISA-60079-29-1, *Explosive Atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable gases,* 2013.

ANSI/ISA-60079-29-2, *Explosive Atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen,* 2012.

ISA-TR12.13.03, *Guide for Combustible Gas Detection as a Method of Protection,* 2009.

E.1.2.8 NACE Publications. NACE International, 15835 Park Ten Place, Houston, TX 77084-4906.

Recommended Practices RP01 series.

Δ **E.1.2.9 UL Publications.** Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials,* 2008, revised 2013.

ANSI/UL 2075, *Gas and Vapor Detectors and Sensors,* 2013.

Hazardous Location Equipment Directory, 2014.

E.1.2.10 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 40, Code of Federal Regulations, Part 761.30.

OSHA, Title 29, Code of Federal Regulations, Part 1910.156.

OSHA, Title 29, Code of Federal Regulations, Part 1910.1000.

E.1.2.11 WEF Publications. Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314.

Design of Municipal Wastewater Treatment Plants — Manual of Practice (MOP) 8, 5th edition, 2009.

E.2 Informational References. The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems*, 2017 edition.

NFPA 86, *Standard for Ovens and Furnaces*, 2019 edition.

ACGIH, *Industrial Ventilation — A Manual of Recommended Practice for Operation and Maintenance,* 2007.

Great Lakes Upper Mississippi Board of State Public Health and Environmental Managers, *Recommended Standards for Wastewater Facilities (10 State Standard),* Health Education Services, Albany, NY, 1990.

Kavassik, I. J., W. C. Krutzsch, W. H. Fraser, and J. Messina, *Pump Handbook,* McGraw-Hill, Inc., New York, 1986.

Metcalf and Eddy, Inc., *Wastewater Engineering: Collection and Pumping of Wastewater,* McGraw-Hill, Inc., New York, 1981.

Metcalf and Eddy, Inc., *Wastewater Engineering: Treatment, Disposal and Reuse* (3rd ed.), McGraw-Hill, Inc., New York, 1985.

Sanks, R. L., G. Tchobanoglous, D. Newton, B. E. Bosserman, and G. M. Jones, *Pumping Station Design,* Butterworth Publishers, Stoneham, MA, 1989.

E.3 References for Extracts in Informational Sections.

NFPA 70®, National Electrical Code®, 2017 edition.

Index

Sequence of Events for the Standards Development Process

Once the current edition is published, a Standard is opened for Public Input.

Step 1 – Input Stage

- Input accepted from the public or other committees for consideration to develop the First Draft
- Technical Committee holds First Draft Meeting to revise Standard (23 weeks); Technical Committee(s) with Correlating Committee (10 weeks)
- Technical Committee ballots on First Draft (12 weeks); Technical Committee(s) with Correlating Committee (11 weeks)
- Correlating Committee First Draft Meeting (9 weeks)
- Correlating Committee ballots on First Draft (5 weeks)
- First Draft Report posted on the document information page

Step 2 – Comment Stage

- Public Comments accepted on First Draft (10 weeks) following posting of First Draft Report
- If Standard does not receive Public Comments and the Technical Committee chooses not to hold a Second Draft meeting, the Standard becomes a Consent Standard and is sent directly to the Standards Council for issuance (see Step 4) or
- Technical Committee holds Second Draft Meeting (21 weeks); Technical Committee(s) with Correlating Committee (7 weeks)
- Technical Committee ballots on Second Draft (11 weeks); Technical Committee(s) with Correlating Committee (10 weeks)
- Correlating Committee Second Draft Meeting (9 weeks)
- Correlating Committee ballots on Second Draft (8 weeks)
- Second Draft Report posted on the document information page

Step 3 – NFPA Technical Meeting

- Notice of Intent to Make a Motion (NITMAM) accepted (5 weeks) following the posting of Second Draft Report
- NITMAMs are reviewed and valid motions are certified by the Motions Committee for presentation at the NFPA Technical Meeting
- NFPA membership meets each June at the NFPA Technical Meeting to act on Standards with "Certified Amending Motions" (certified NITMAMs)
- Committee(s) vote on any successful amendments to the Technical Committee Reports made by the NFPA membership at the NFPA Technical Meeting

Step 4 – Council Appeals and Issuance of Standard

- Notification of intent to file an appeal to the Standards Council on Technical Meeting action must be filed within 20 days of the NFPA Technical Meeting
- Standards Council decides, based on all evidence, whether to issue the standard or to take other action

Notes:

1. Time periods are approximate; refer to published schedules for actual dates.
2. Annual revision cycle documents with certified amending motions take approximately 101 weeks to complete.
3. Fall revision cycle documents receiving certified amending motions take approximately 141 weeks to complete.

Committee Membership Classifications[1,2,3,4]

The following classifications apply to Committee members and represent their principal interest in the activity of the Committee.

1. M *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.
2. U *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.
3. IM *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.
4. L *Labor:* A labor representative or employee concerned with safety in the workplace.
5. RT *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.
6. E *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.
7. I *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.
8. C *Consumer:* A person who is or represents the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in (2).
9. SE *Special Expert:* A person not representing (1) through (8) and who has special expertise in the scope of the standard or portion thereof.

NOTE 1: "Standard" connotes code, standard, recommended practice, or guide.

NOTE 2: A representative includes an employee.

NOTE 3: While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of member or unique interests need representation in order to foster the best possible Committee deliberations on any project. In this connection, the Standards Council may make such appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.

NOTE 4: Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

Submitting Public Input / Public Comment Through the Online Submission System

Following publication of the current edition of an NFPA standard, the development of the next edition begins and the standard is open for Public Input.

Submit a Public Input

NFPA accepts Public Input on documents through our online submission system at www.nfpa.org. To use the online submission system:

- Choose a document from the List of NFPA codes & standards or filter by Development Stage for "codes accepting public input."
- Once you are on the document page, select the "Next Edition" tab.
- Choose the link "The next edition of this standard is now open for Public Input." You will be asked to sign in or create a free online account with NFPA before using this system.
- Follow the online instructions to submit your Public Input (see www.nfpa.org/publicinput for detailed instructions).
- Once a Public Input is saved or submitted in the system, it can be located on the "My Profile" page by selecting the "My Public Inputs/Comments/NITMAMs" section.

Submit a Public Comment

Once the First Draft Report becomes available there is a Public Comment period. Any objections or further related changes to the content of the First Draft must be submitted at the Comment Stage. To submit a Public Comment follow the same steps as previously explained for the submission of Public Input.

Other Resources Available on the Document Information Pages

Header: View document title and scope, access to our codes and standards or NFCSS subscription, and sign up to receive email alerts.

Research current and previous edition information.

Follow the committee's progress in the processing of a standard in its next revision cycle.

View current committee rosters or apply to a committee.

For members, officials, and AHJs to submit standards questions to NFPA staff. Our Technical Questions Service provides a convenient way to receive timely and consistent technical assistance when you need to know more about NFPA standards relevant to your work.

Provides links to available articles and research and statistical reports related to our standards.

Discover and purchase the latest products and training.

View related publications, training, and other resources available for purchase.

Information on the NFPA Standards Development Process

I. Applicable Regulations. The primary rules governing the processing of NFPA standards (codes, standards, recommended practices, and guides) are the NFPA *Regulations Governing the Development of NFPA Standards (Regs)*. Other applicable rules include NFPA *Bylaws*, NFPA *Technical Meeting Convention Rules*, NFPA *Guide for the Conduct of Participants in the NFPA Standards Development Process*, and the NFPA *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council*. Most of these rules and regulations are contained in the *NFPA Standards Directory*. For copies of the *Directory*, contact Codes and Standards Administration at NFPA headquarters; all these documents are also available on the NFPA website at "www.nfpa.org/regs."

The following is general information on the NFPA process. All participants, however, should refer to the actual rules and regulations for a full understanding of this process and for the criteria that govern participation.

II. Technical Committee Report. The Technical Committee Report is defined as "the Report of the responsible Committee(s), in accordance with the Regulations, in preparation of a new or revised NFPA Standard." The Technical Committee Report is in two parts and consists of the First Draft Report and the Second Draft Report. (See *Regs* at Section 1.4.)

III. Step 1: First Draft Report. The First Draft Report is defined as "Part one of the Technical Committee Report, which documents the Input Stage." The First Draft Report consists of the First Draft, Public Input, Committee Input, Committee and Correlating Committee Statements, Correlating Notes, and Ballot Statements. (See *Regs* at 4.2.5.2 and Section 4.3.) Any objection to an action in the First Draft Report must be raised through the filing of an appropriate Comment for consideration in the Second Draft Report or the objection will be considered resolved. [See *Regs* at 4.3.1(b).]

IV. Step 2: Second Draft Report. The Second Draft Report is defined as "Part two of the Technical Committee Report, which documents the Comment Stage." The Second Draft Report consists of the Second Draft, Public Comments with corresponding Committee Actions and Committee Statements, Correlating Notes and their respective Committee Statements, Committee Comments, Correlating Revisions, and Ballot Statements. (See *Regs* at 4.2.5.2 and Section 4.4.) The First Draft Report and the Second Draft Report together constitute the Technical Committee Report. Any outstanding objection following the Second Draft Report must be raised through an appropriate Amending Motion at the NFPA Technical Meeting or the objection will be considered resolved. [See *Regs* at 4.4.1(b).]

V. Step 3a: Action at NFPA Technical Meeting. Following the publication of the Second Draft Report, there is a period during which those wishing to make proper Amending Motions on the Technical Committee Reports must signal their intention by submitting a Notice of Intent to Make a Motion (NITMAM). (See *Regs* at 4.5.2.) Standards that receive notice of proper Amending Motions (Certified Amending Motions) will be presented for action at the annual June NFPA Technical Meeting. At the meeting, the NFPA membership can consider and act on these Certified Amending Motions as well as Follow-up Amending Motions, that is, motions that become necessary as a result of a previous successful Amending Motion. (See 4.5.3.2 through 4.5.3.6 and Table 1, Columns 1-3 of *Regs* for a summary of the available Amending Motions and who may make them.) Any outstanding objection following action at an NFPA Technical Meeting (and any further Technical Committee consideration following successful Amending Motions, see *Regs* at 4.5.3.7 through 4.6.5) must be raised through an appeal to the Standards Council or it will be considered to be resolved.

VI. Step 3b: Documents Forwarded Directly to the Council. Where no NITMAM is received and certified in accordance with the *Technical Meeting Convention Rules*, the standard is forwarded directly to the Standards Council for action on issuance. Objections are deemed to be resolved for these documents. (See *Regs* at 4.5.2.5.)

VII. Step 4a: Council Appeals. Anyone can appeal to the Standards Council concerning procedural or substantive matters related to the development, content, or issuance of any document of the NFPA or on matters within the purview of the authority of the Council, as established by the *Bylaws* and as determined by the Board of Directors. Such appeals must be in written form and filed with the Secretary of the Standards Council (see *Regs* at Section 1.6). Time constraints for filing an appeal must be in accordance with 1.6.2 of the *Regs*. Objections are deemed to be resolved if not pursued at this level.

VIII. Step 4b: Document Issuance. The Standards Council is the issuer of all documents (see Article 8 of *Bylaws*). The Council acts on the issuance of a document presented for action at an NFPA Technical Meeting within 75 days from the date of the recommendation from the NFPA Technical Meeting, unless this period is extended by the Council (see *Regs* at 4.7.2). For documents forwarded directly to the Standards Council, the Council acts on the issuance of the document at its next scheduled meeting, or at such other meeting as the Council may determine (see *Regs* at 4.5.2.5 and 4.7.4).

IX. Petitions to the Board of Directors. The Standards Council has been delegated the responsibility for the administration of the codes and standards development process and the issuance of documents. However, where extraordinary circumstances requiring the intervention of the Board of Directors exist, the Board of Directors may take any action necessary to fulfill its obligations to preserve the integrity of the codes and standards development process and to protect the interests of the NFPA. The rules for petitioning the Board of Directors can be found in the *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council* and in Section 1.7 of the *Regs*.

X. For More Information. The program for the NFPA Technical Meeting (as well as the NFPA website as information becomes available) should be consulted for the date on which each report scheduled for consideration at the meeting will be presented. To view the First Draft Report and Second Draft Report as well as information on NFPA rules and for up-to-date information on schedules and deadlines for processing NFPA documents, check the NFPA website (www.nfpa.org/docinfo) or contact NFPA Codes & Standards Administration at (617) 984-7246.