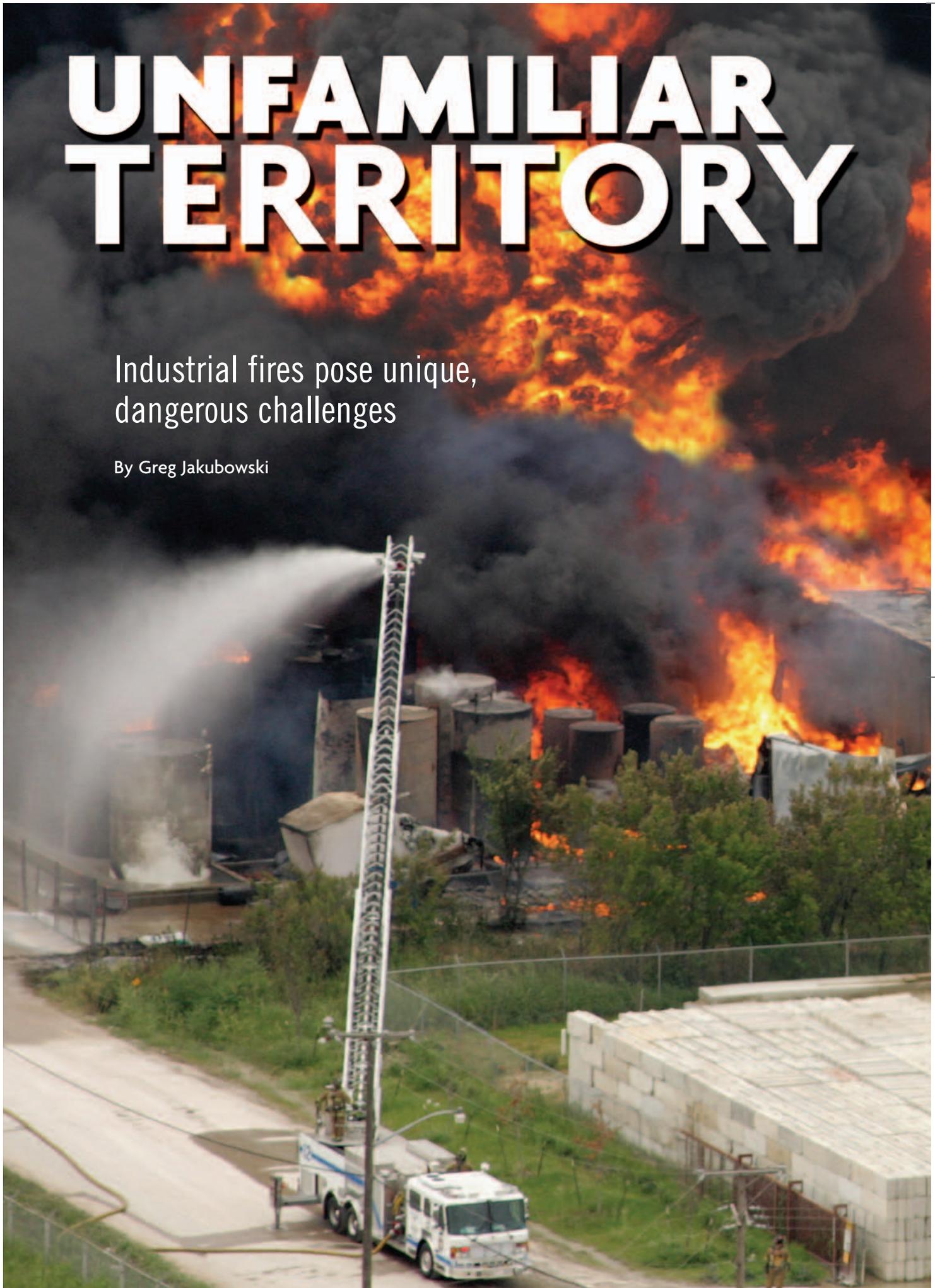


UNFAMILIAR TERRITORY

Industrial fires pose unique, dangerous challenges

By Greg Jakubowski





With few exceptions, fire departments across North America are most familiar with and most confident responding to incidents at residential or light commercial occupancies. Firefighting at industrial facilities, however, poses an entirely different set of challenges and hazards, which include not only fire, but also explosions and overpressures, electrocution, pressurized fires and exposure to noise and chemicals. These hazards require firefighters to employ tactics somewhat different from those employed in residential/commercial buildings. Why? Industrial plants usually include such systems as air, water, steam, gas or other utilities that operate under high pressure and/or in high or low temperatures. Plants of almost any size include utility areas that generate or receive these utilities (such as steam or compressed air) and modify them (such as in natural gas pressure-reducing stations) for plant use or handle them as waste streams. In addition, the trend within industrial facilities is moving toward the extreme, meaning they utilize very high pressures and temperatures or very low temperatures, which can create specific problems.

This article will describe industrial facility areas, their potential hazards and which tactics and strategies firefighters should employ to combat them.

PHOTO RON JENKINS

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Given the types of combustible materials and/or chemicals stored in and used by industrial plants, you may need to apply water or foam agents from a distance.

UTILITY AREAS

Many hazards found in utility areas are not unlike those faced daily by responders involved in routine natural gas and electricity incidents, but industrial plants generate or create these hazards on a greater scale. Motor control centers and substation rooms are generally segregated from other plant areas, and much of the smaller equipment found in these rooms doesn't have enough fuel to sustain a fire. Utility-area incidents typically involve an initial arc, flash or explosion without further fire, unless combustible materials are stored in the room. If this is the case, cut the power to the room, and extinguish any burning Class A ordinary combustibles. *Note:* It's critical to verify the power is indeed cut before entering these areas.

One exception to these tactics: incidents involving oil-filled transformers. These transformers are normally located on the building's exterior and can easily hold 2,000 gallons or more of combustible oil. As a result, they can create a significant fire condition in which the incident commander (IC) must determine whether to use extinguishment or burn-out tactics. If

the IC chooses extinguishment, be prepared to use large quantities of foam and large-foam application devices (e.g., master streams) and deal with contaminated runoff. Although industrial facilities have made a concerted effort to remove transformer oil that includes poly-chlorinated biphenyls (PCBs), this oil may still be present; therefore, you must prevent or contain any runoff. First responders should verify the presence of PCBs with facility management.

Electrical Explosions—In a flash or explosion involving electrical equipment in a utility area, conduct searches once the area is determined safe, because workers may be burned and possibly trapped. Many electric utility companies discourage entering high-voltage areas, even if victims are present, until personnel have confirmed absolutely that the power has been cut.

High-Pressure Hazards—Other hazards include high-pressure air, high-pressure steam, natural gas or propane or liquid-combustible fuels. High-pressure steam leaks present unusual hazards because they may not be immediately visible, and in rare situations, they can store enough pressure to damage tissue or even amputate a limb. Applying firefighting water to uninsulated high-pressure steam lines or hot surfaces of boilers or incinerators can result in damage to or failure of the equipment, which can cause overpressures and airborne, hot metal.

Incinerators & Oxidizers—Incinerators are used to burn plant waste, and thermal oxidizers (or fume incinerators) are used to burn off emissions from processes. Due to the high temperatures needed to carry out these operations, this equipment is generally fueled by natural gas or propane. Some incinerators are designed to burn flammable liquids. *Remember:* This equipment is designed to have a fire in it. If called to an incident involving an incinerator, all you may need to do is push the burning material back inside the incinerator. Consult personnel familiar with operating the equipment.

Thermal oxidizers act as furnaces that burn off flammable emissions created by some industrial processes. These emissions would otherwise become air pollutants, and incineration significantly reduces the level of pollution. However, oxidizers can also run the risk of fire spreading back to the process, so it's critical to shut down the process and block fire spread traveling back through the ductwork. Oxidizers are likely to have built-in fire-suppression equipment, which you may need to activate manually. Consult facility personnel, and use built-in equipment wherever possible. Allow the fixed system time to do its job.

If incinerators and oxidizers remain unexposed to an incident and run normally, it may be acceptable to allow the equipment to continue to run. If the equipment is involved in the incident, trained ►

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operators must initiate emergency shutdown procedures. Smaller generators or incinerators with emergency shutdown switches or buttons may be shut down after consulting facility management.

Air Compressors—Normally, air compressors are electrically powered, feature a local shutoff breaker and cycle on and off based on demand. A compressor that appears to be off may suddenly kick on, startling any responders nearby.

Chillers & Cooling Towers—Utility areas also typically use chillers and cooling towers. Chillers may be steam-driven, electricity-driven or operated with ammonia. The steam- and electricity-driven units do not present any unusual hazards other than noise and significant quantities of chilled water piped to and from them. With the exception of ammonia chillers, chemicals used in these units do not present unusual hazards. Ammonia chillers present significant downwind hazards in a release; if concentrations reach high levels—usually in the area of a leak—they can generate an explosive atmosphere.

Cooling towers use large fans at the top to draw in air while water drops through the tower to be cooled. The cooled water is then utilized within the plant for various purposes, such as cooling equipment or processes or providing a cooling source to air-conditioning equipment. When wet, these towers do not present any unusual hazards. When dry, cooling towers of wood or plastic construction can be highly combustible, requiring exposure protection from adjacent fires or large streams to knock down an impressive fire when they become involved. *Note:* Use caution when applying cold water or carbon dioxide (CO₂) extinguishing agent to rotating blades of any equipment; these blades may be hot, and suddenly applying a cold agent to them could shatter, warp and/or permanently damage them.

Sound & Movement Hazards—Utility areas are often noisy when equipment is running, which can be hazardous to your ears and create communication challenges. Firefighters should be prepared to don hearing protection when entering industrial facilities. Look for plant communication equipment areas—places set up with sound-absorbing material and a phone. Stepping into these areas can facilitate radio or other communications. Identifying these areas before the incident in documented preplans can simplify your response.

Utility areas also feature many pieces of equipment with moving parts. Although regulations require proper guards for this sort of equipment, the guards may not be present during an incident, which could create a mechanical hazard to responders. General procedures for incidents in utility areas should include working with management to shut down and lock out all involved equipment, as well as the utilities supplying the equipment. *Important:* Fixed CO₂ suppression systems (or other total flooding gas-suppression systems) may be used in utility areas. If there's even a hint that a CO₂ sys-

tem has discharged (or may discharge), use oxygen monitors and/or SCBA in and around these areas, and ventilate them thoroughly. Consider using large CO₂ or dry-chemical extinguishers to fight fires in equipment, particularly if they are available in the area of the incident. *Remember:* Dry chemical can create collateral damage. It may also be appropriate to just evacuate the area and let the incident run its course—property can be insured, but people can't.

MAINTENANCE AREAS

Industrial facilities of any appreciable size include maintenance areas. Maintenance or “shop” areas possess the same hazards present in almost any firehouse, such as compressed air and electricity to run equipment, paints, oils, greases and cleaning solvents needed to properly maintain plant equipment. Expect to find normal mechanical hazards around any moving equipment, such as saws, drill presses, grinders and similar equipment, as well as small quantities of flammable/combustible liquids (although paint areas may store large quantities). Be prepared with larger dry-chemical or CO₂ extinguishers or perhaps a foam handline. Before entering these areas, ensure power is cut to the involved section.

PROCESSING AREAS

All industrial facilities “do” something. During industrial processes, reactions may occur, and materials may be mixed, heated or cooled; industrial heat-treating and drying often involve natural gas or propane. As a result, shutting off the gas is one of the first response steps you should take during incidents involving processing equipment. *Important:* Coordinate with plant management to understand what equipment will be affected by shutting off the gas, which could significantly impact plant operations and cause additional equipment damage.

It's not easy to make an aggressive offensive attack in large processing structures. In these situations, use large volumes of water, perhaps via aerial master streams, to cool exposed equipment, and shut down valves supplying fuel, gas or process liquids to the equipment. At the same time, command officers must monitor the structural supports for the involved equipment to determine their strength. You may need to apply cooling streams to the structural steel to prevent collapse.

Along with the equipment supports, runoff must also be monitored. Is there a drainage system at the site designed to handle contaminated runoff or emergency valves that must be closed to prevent drainage into nearby waterways? If so, once the valves are closed, where will the runoff go? If these issues are at hand, you may need to establish large groups to deal with them. *Note:* Certain industrial processes, particularly those that utilize flammable liquids, may feature fire-safe valves that close automatically when exposed to flames. These valve shutdowns can close off continuous flow of fuel to the fire, so don't be surprised if the fire goes out on its own. ▶

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PHOTO GLEN ELLMAN

Firefighters arriving at a significant event in a storage area should first protect exposures and remove victims. Then, ensure fixed-suppression systems are activated.

Many industrial facilities now use “clean” rooms that require special air filtration and can become seriously damaged by smoke or water. Know the locations of these rooms and what your department can do to prevent smoke and water from entering them.

WAREHOUSING & STORAGE AREAS

Almost every industrial facility includes at least one warehouse, which presents unusual challenges to firefighters. Warehouses are used to store both raw materials and finished goods; some store material on racks 30–45 feet high (and sometimes 90–100 feet high in high-bay areas). Fires up in the racks require the use of ground ladders inside the building and fire streams with significant reach. Working on fires overhead presents collapse hazards to personnel. Fire spread may be rapid, particularly if there are large, undivided areas within the warehouse. Use firewalls to contain fires and protect openings in the walls. Consider the need for specialized heavy equipment to deal with fires up in rack areas. These incidents also require a lot of air movement to ventilate the structure, so call for lots of big fans.

The stored raw materials may be significantly hazardous to responders, because they may be flammable, corrosive or unstable/reactive. Production areas normally require large amounts of raw materials, and thus storage tanks, or various means of outside storage. Hopefully, the facility has stored these materials responsibly, keeping them a safe distance away from potential exposures nearby and/or providing fixed fire-suppression systems.

Initially, firefighters arriving at a significant event in a storage area should protect exposures and remove victims, unless they have preplanned specific tactics for these areas. Then, ensure fixed-suppression systems are

activated. Once the situation has been confirmed, a more aggressive course of action (offensive attack) may be called for.

Any type of significant storage, whether solid, liquid or gas, requires a means of transfer to get to its point of use. Liquid or gas generally requires pipe racks or underground lines, which are sometimes located in covered trenches. Two keys to incidents involving pipe leaks: Access shut-off valves, and control the leak and any runoff. Knowing in advance the locations of these valves and where drains empty will expedite your intervention.

Finally, facilities performing industrial operations create waste, which may consist of all sorts of things that may also be warehoused on site. Knowing in advance the location of the waste storage and which hazards it poses will expedite decision making. At the very least, runoff from incidents involving these areas must be controlled.

For more information on handling fires in warehouse areas, see “Big Burns: Making your way through warehouse fires,” in the May 2005 issue of *FireRescue*.

COMPUTER AREAS

Computers seem to run everything these days; this is particularly true in most industrial facilities. Although most computers have become smaller in size, most industrial plants feature one or more computer rooms, and there may be a separate data facility for telephone switching. These facilities are key to the site’s operation. To accommodate the many data cables necessary for communication, the floors in these rooms are normally raised several inches to several feet; therefore, you must check the space under the floor for fire spread. Assume all cabling has significant power to it until you can confirm otherwise. ▶

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PHOTO 911 PICTURES/JEREMY GREENE

Fires involving storage/utility areas at industrial facilities can require a heavy attack. Knowing what is in these buildings before an incident will facilitate the choice of tactics.

These rooms may also feature built-in suppression agents (normally some type of gas) above and/or below the floor. If a fire is confirmed in a computer area (something more than an odor of smoke), and the agent has not discharged, trip the suppression system so it can do its job. If the system has discharged, use SCBA until the room is fully ventilated, since some suppressant gases can convert to toxic gases when heated.

Be prepared to use some type of clean-agent fire extinguisher, which you might find in the room. If you have no choice, use a CO₂ extinguisher, but avoid using dry chemical if at all possible, since the chemical will spread throughout the room, potentially causing more damage than the fire itself.

In all cases, defend computer areas against incidents in surrounding areas, and check not only for fire extension, but also for water seepage under the floor. Lastly, be prepared to provide a lot of ventilation to properly clear out these rooms.

LABORATORY AREAS

Many industrial sites feature a lab of some sort, which may serve as a space for conducting research and development, but it's more likely used for quality control. These labs often keep small quantities of flammable liquids inside them; therefore, most lab fires are small. A decent-size CO₂ extinguisher should do the trick without creating a lot of collateral damage, but quickly provide back up for the extinguisher with a handline, preferably one with foam (CAFS can be nice).

In all cases, wear SCBA until air monitoring can confirm a lack of toxic materials, and prepare to heavily ventilate the room. Be aware that other reactions may be going on inside the room, since some lab tests take hours to complete. Get a lab technician to fill you in on

which tests are being performed, and what must be done to control the fire.

ADMINISTRATION AREAS/SALES COUNTERS

No matter how small the site, it likely features an administration area and/or sales counter. Responding to incidents in these areas is much like responding to any other office building in your district. They may contain critical records, paper or electronic, that you must recover to help the facility stay in business. If you know the location of these records and how to access/protect them, the employees will truly appreciate your efforts.

CONSTRUCTION LAY-DOWN AREAS

Many industrial sites contain construction lay-down yards where contractors can stage any sort of material, combustible or not, for their current projects. Temporary storage and office trailers are most likely located here as well. Many of these units can burn quickly, and likely have oxy-acetylene units, propane or other hazards in or around them.

In most cases, fires of any significance involving these areas require a defensive attack. Establish a good water supply, and protect exposures from a safe distance.

SUMMARY

Industrial sites often anticipate fire as a potential hazard and feature built-in systems, such as suppression systems and on-site water supplies, to protect against it. It behooves firefighters to know where these systems are, how they work and how to use them before a fire strikes. It is only through preplanning that firefighters will know a site has a manually operated fire pump they must turn on to work properly, or that a gas shut-off is behind some bushes or the location of the emergency activation switch for the gas generator's fire-suppression system.

Upon arrival at an industrial incident, find a knowledgeable facility representative and get briefed on what's going on and what they can do to help you. Keep them at the command post for the duration of the incident. Then take a moment to study the incident. Where is it going? Can the hazard/problem be shut down? What if you do nothing? (That just might be an option you want to consider.)

Make sure personnel are assigned to verify that all plant fire water-supply equipment is operating properly, and continue to monitor this. *Remember:* Industrial facilities are valuable to your community's economy but may present unusual challenges to your response. Take your time, understand the hazards and the options, and you'll keep your personnel safe while effectively eliminating the problem. ☺

Greg Jakubowski is a fire protection engineer and certified safety professional with 25 years of fire-service experience. He is a Pennsylvania State Fire Instructor and serves as a captain with the Lingohocken Fire Company in Bucks County, Pa. Greg also works as a principal in Fire Planning Associates, a company dedicated to helping firefighters and businesses with pre-emergency planning.