Utility Failure Tip Sheet
OXYGEN

Health care facilities can be affected by short- or long-term oxygen shortages or pressure loss due to excess demand, infrastructure damage, power failures, or supply chain challenges. Oxygen is a key component of patient care, and the supply systems are vulnerable. System failure can jeopardize lives and force emergency evacuation of patients. Facility planners must first consider local hazards that can lead to partial or total source interruptions (e.g., natural disasters, infrastructure/technology failure, malicious or accidental damage). Facility planners and engineers should understand consumption rates while establishing triggers and strategies for oxygen conservation during a crisis. These planning steps combined with training and conducting and/or participating in exercises with relevant facility staff, medical oxygen providers, and key community partners can increase operational resiliency. As facilities review their medical gas vulnerabilities, they should also consider their compressed air and suction needs as well as specialty gas issues.

The following considerations are based on an individual facility's short-term oxygen shortage:

- Estimate average oxygen demand considering factors such as the size of the facility and number and types of patients served.
- Consider whether the facility is vulnerable to incidents (including those requiring increased use of ventilators and high-flow oxygen therapies as occurred during the COVID-19 pandemic) that may cause an increase in patients who require oxygen; estimate the surge demand.
- Determine what measures can be put in place to conserve the oxygen supply (e.g., postponement of elective surgical procedures, restrictions on the use of oxygen [e.g., titration to need, switching to inhalers from nebulizers], switch to reservoir nasal cannulas).
- Inspect and maintain operating condition of gas delivery systems.
- Correct inefficiencies as soon as they are identified (e.g., fix leaking wall outlets, close oxygen circuits when masks are not in use, turn off unused flow meters).
- Establish process to rapidly assess the effects of an oxygen-related incident on clinical or support operations and determine the need to activate incident command.
- Follow processes outlined in business continuity plan.
- Establish contracts with backup liquid oxygen suppliers and with compressed oxygen cylinder and oxygen concentrator vendors, including provisions on delivery times for emergency supply requests.
- Understand your onsite backup system, duration of expected supply, and time until supplier can provide sustained onsite support for a failed primary system. This will drive patient care and evacuation decisions should the system fail.
- Follow local, state, and/or other reporting or regulatory requirements related to interruption or restoration of oxygen-related services.

Facility planners should also be aware that community members reliant on home oxygen often go to health care facilities to charge oxygen concentrators during power outages or obtain refills of personal oxygen cylinders during disasters. Health care facilities should collaborate with their health care coalition, oxygen vendors/durable medical equipment providers, and other partners to understand the community's alternate care site and shelter plans and assess their suitability for community-dwelling oxygen users. They should also explore the availability of charging stations/trailers that community members can use to plug in their concentrators. The ability to meet the needs of community-dwelling oxygen users at designated locations – and communicating their availability – can help prevent members of the public who do not need medical attention from seeking assistance at health care facilities.

ASPR
Administration for Strategic Preparedness and Response
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Healthcare Emergency Preparedness Information Gateway

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- Evaluate piped gas capacity and maximum storage as well as vulnerabilities to damage.
- Understand how to isolate or bypass damaged system components.
- Determine whether and where gas piping is available in areas of the facility where oxygen is not normally used but may be converted during a patient surge.
- Know the location of supply valves/shutoffs.
- Inspect wall outlets regularly to ensure they are not leaking.
- Follow preventive maintenance schedules.
- Determine whether the primary and backup storage tanks use different piping and connections. If not, explore options to separate them to ensure one liquid oxygen source will be available if the other is damaged. The manifold that controls distribution from a secondary source should be maintained and checked regularly.
- Determine if an emergency oxygen supply connection (EOSC) is available if the system is damaged (or the tank is inaccessible for deliveries). Confirm that lines connected to the EOSC can independently support sufficient pressure and volume to maintain the oxygen supply. Ensure any temporary locations for liquid oxygen distribution or connection to the EOSC are adequate and have a compatible surface (i.e., concrete rather than asphalt, ability to put a pad down if needed).
- Maintain contact information for liquid oxygen vendors and their plan and timeline to resupply the facility after an emergency in the event of damage to roads/infrastructure.
- Monitor line pressure and have response plans for pressure drops, particularly during high demand.
- During high demand, monitor vaporizers for ice accumulation and be prepared to spray with water or use steam for deicing.
- Ensure air circulation around vaporizers is not obstructed.
- Prevent interference with oxygen delivery equipment (e.g., due to hanging items on medical gas plugins or fittings in patient rooms).
- Consider mixing high and low/no oxygen demand patients on units rather than stressing the delivery system by having all high use patients in the same location.
- Close zone valves before and after a damaged section of the system and backfill with large cylinders or liquid.
- Stock extra parts for a faster repair response.

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- Evaluate the quantity of gas available in cylinders and how it is distributed in the facility.
- Ensure that the piping from a backup cylinder system is large enough to maintain adequate flow and pressure to the facility.
- Understand which size cylinders can be used for individual patients versus those that can be connected to the piped gas lines.
- Adhere to National Fire Protection Association and state or local regulations related to the storage and handling of compressed gas cylinders.
- Ensure proper storage, stock rotation, and restocking.
- Determine feasibility of stocking extra cylinders given the storage requirements.
- Consider purchasing a commercial cylinder storage system that can be wheeled to the location of need.
- Consider stocking cylinders with regulators already attached to ensure enough regulators are available.
- Consider stocking cylinders with integrated valves, regulators, and flow meters to reduce safety risks when changing regulators.
- Determine how and why cylinders will be distributed throughout the facility and the staff required to move, monitor, and switch them out when empty.
- Understand that pressure will drop with increased distance between the cylinder and the delivery device.
- Promptly return spent cylinders to vendors to be refilled and resupplied.

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- Determine feasibility of having a fixed or portable (trailer-based) oxygen concentrator system as a backup to supply piped oxygen system or to refill cylinders. Ensure trailer and facility connections are compatible.
- Ensure large oxygen concentrators are connected to the backup power system in the event of an electrical outage.

KEY N Need C Considerations

Related ASPR TRACIE Resources

- Utility Failures Topic Collection
- Considerations for Oxygen Therapy in Disasters
- Utility Failures in Health Care Toolkit

Other Resources

- Oxygen Supplies in Disaster Management
- Oxygen Supplies During a Mass Casualty Situation
- Medical Air and Oxygen Capacity Assessment Tool
- Medical Gas Cylinder Storage
- Health Facility Medical Oxygen Systems Best Practices During COVID-19 Pandemic
- Oxygen Sources and Distribution for COVID-19 Treatment Centers