APPLIED ALCHEMY [PART 1 OF 6]

Batteries and the Hazard Communication Standard

Understanding how battery systems are governed under the OSHA standard is essential to ensuring employee safety.

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Batteries have become a critical component of electric utility operations. Once limited to backup power in substations and control rooms, energy storage now drives innovation across the grid. As use of batteries increases, so does the responsibility to manage the unique chemical and physical hazards they introduce. Understanding how battery systems are governed under OSHA 29 CFR 1910.1200, "Hazard Communication," is essential to ensuring worker safety, regulatory compliance and operational reliability.

Energy Storage and the HCS

Electric utilities sit at the center of the energy transition. The shift toward renewable generation, distributed energy resources and grid modernization has made large-scale energy storage critical to system reliability. Lithium-ion batteries have revolutionized grid-scale storage with fast response times, high efficiency and the ability to smooth fluctuations in renewable output. Meanwhile, sealed lead-acid batteries remain vital in substation operations, providing emergency power for relays, switchgear and communication systems. As utilities expand energy storage, workers encounter a growing variety of battery chemistries and configurations, each with distinct hazards that must be identified, communicated and controlled.

OSHA's 1910.1200 hazard communication standard (HCS) is a right-to-know law intended to ensure that employees understand the hazardous chemicals they may be exposed to, the risks involved and how to protect themselves. Under the HCS, employers must maintain an inventory of all hazardous chemicals in the workplace; make safety data sheets readily accessible; verify all relevant containers and systems are properly labeled; and provide training to teach employees how to interpret and act on this information. Employers also must maintain a written hazard communication program describing how these requirements are met. For utilities, this means batteries – regardless of type – must be assessed for chemical hazards, just like any other regulated substance.

Battery Types and Risks

Different batteries pose different risks depending on their chemistry and use.

Lead-acid batteries, common in backup systems and mobile equipment, contain lead, lead oxide and sulfuric acid. Risks are limited when these batteries are intact, but hydrogen gas and acid mist can be released during charging or maintenance, creating fire and health hazards.

The dominant choice for grid storage, **lithium-ion batteries** contain flammable electrolytes and lithium salts that can react violently if overheated, overcharged or damaged, leading to thermal runaway and potential fires.

Nickel-based batteries, such as nickel-cadmium and nickel-metal hydride, are valued for their durability in extreme conditions but contain toxic and corrosive materials (e.g., nickel, potassium hydroxide). Note that cadmium is a regulated carcinogen under OSHA 1910.1027.

Flow batteries, used for long-duration storage, rely on circulating electrolytes such as vanadium or zinc-bromine. Leaks and spills can create corrosive and environmental hazards.

And while designed for improved safety, even **sodium-based and solid-state batteries** may present reactivity or fire risks if damaged or mishandled.

HCS Misconceptions

One persistent misconception among professionals in the utility industry is that sealed batteries are entirely exempt from OSHA's HCS. The fact is that the standard applies to any workplace in which employees may be exposed to hazardous chemicals – including those contained in batteries. Sealed or intact batteries may be partially exempt if they do not release hazardous substances under normal use. However, once a battery is charged, serviced, recycled or damaged, it could release hazardous materials, thus requiring full HCS compliance. This means utilities must maintain easily accessible safety data sheets for every battery type; ensure battery storage and charging areas are clearly labeled; and provide training to workers who install and maintain batteries and/or respond to battery-related incidents.

Other misconceptions could lead to HCS compliance gaps as well, such as "sealed means safe." Sealed batteries may vent gases and electrolytes due to heat, mechanical stress and overcharging. Additionally, some industry workers believe OSHA's HCS applies only to chemicals, but its scope covers equipment that contains or could release hazardous chemicals. And although some assume that safety data sheets are required only for substances employees pour or mix, OSHA explicitly demands sheets for all hazardous chemicals an employee could be exposed to, including those found inside batteries.

Hazard Management

To successfully manage battery-related hazards, a utility organization must develop and maintain a structured, proactive approach that integrates chemical safety protocols into daily operations. Begin by conducting a comprehensive battery inventory, identifying all systems, types, quantities and locations. Mapping the hazards for each battery type will help to determine potential exposures during installation, charging, maintenance and disposal. Based on the assessment results, establish a battery management plan that outlines procedures for safe handling, storage, charging, spill control and emergency response. The plan should define inspection intervals and maintenance responsibilities.

Effective hazard management relies on effective employee training. Workers must understand battery-specific hazards, proper personal protective equipment use, labeling systems and emergency procedures. Employers must ensure safety data sheets and labels are available in both office and field environments. Equip facilities with spill kits, adequate ventilation and fire suppression systems designed for the batteries in use (e.g., Class D extinguishers for lithium fires). Design storage areas to prevent interactions among incompatible materials.

Finally, utilities should regularly review and update their HCS programs. As new battery chemistries and technologies are introduced, programs must be modernized to capture new hazards, revise safety data sheet inventories and refresh employee training. Periodic audits help to ensure programs remain compliant and aligned with current industry best practices.

Conclusion

Batteries are transforming the electric utility industry, enabling cleaner, more reliable and more flexible power systems. Yet with these innovations comes a great amount of responsibility for employers and employees. By heightening our understanding of OSHA's HCS and how it applies to batteries – and dispelling myths regarding battery use – we can more safely and sustainably embrace energy storage. Inventorying systems, mapping hazards and empowering workers through training aid in the protection of people and infrastructure while guiding us toward a more resilient and decarbonized energy future.

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