Yes, several fires at large-scale battery farms, also known as Battery Energy Storage Systems (BESS), have resulted in environmental hazards. A prominent example is the fire at the Vistra facility in Moss Landing, California, which has led to significant environmental scrutiny and legal action.

Case study: Moss Landing, California (January 2025)

In January 2025, a fire at the Vistra energy storage facility in Moss Landing released a plume of toxic smoke, causing evacuations and ongoing environmental concerns.

- **Toxic heavy metals**: After the fire, soil tests conducted by researchers found elevated concentrations of heavy metals, such as nickel, manganese, cobalt, and copper, in the nearby marshland and surrounding areas. These metals can contaminate soil and water, posing long-term risks to local ecosystems and agriculture.
- **Contamination pathway**: The lithium-ion battery fire produced harmful substances that settled in the surrounding area through smoke and firefighting water runoff. The incident raised questions about the safety of produce grown in the nearby Salinas Valley agricultural region.
- **Health effects**: Local residents reported symptoms such as headaches, sore throats, and burning eyes, and some filed a lawsuit alleging contamination and negligence.
- **Official response**: Following the fire, California legislators and utility regulators proposed new rules for the design and location of battery storage facilities.

Broader environmental concerns from battery fires

Fires at battery farms create environmental hazards beyond immediate contamination.

- **Air contamination**: The combustion of lithium-ion batteries releases a cocktail of toxic gases and fine particulate matter, including hydrogen fluoride, carbon monoxide, carbon dioxide, and heavy metal particles. Exposure to these airborne toxins can lead to serious respiratory and other health issues for workers and nearby communities.
- **Water and soil contamination**: Firefighting efforts can spread contaminants. Water runoff from extinguishing a battery fire can carry metals and combustion-related polyaromatic hydrocarbons (PAHs) into surface soils and waterways. In areas with sensitive ecosystems, like the wetlands near Moss Landing, this can be particularly damaging.
- **Challenges for emergency response**: Battery fires are particularly hazardous because they are difficult to extinguish and can reignite. They can also produce flammable and potentially explosive gases. The unique risks of lithium-ion fires require specialized training for firefighters and often lead to non-traditional suppression methods, such as allowing the fire to burn out or covering it with specialized materials.

Regulatory and industry response

Following incidents like the one in Moss Landing, both governments and the industry have taken action to address the environmental and safety risks.

- Regulatory proposals in California aim to restrict where battery farms can be located.
- New industry standards and blueprints for safety are being developed and implemented.
- Some projects are exploring alternative battery technologies, such as iron-flow systems, that do not use lithium and are safer.

During a fire caused by thermal runaway, lithium-ion batteries release a variety of toxic and flammable chemicals, including hazardous gases, organic compounds, and heavy metal particulates

. The specific chemicals and their concentrations depend on the battery's composition and the fire's intensity.

Gases and their health effects

- **Hydrogen Fluoride (HF):** Extremely corrosive and toxic, this gas can cause severe respiratory irritation and chemical burns upon contact. Exposure can lead to chronic respiratory problems like asthma or pulmonary fibrosis, and in high concentrations, it can be fatal. When it mixes with water in the lungs or on the skin, it becomes hydrofluoric acid, which is highly damaging to tissues and can cause potentially fatal systemic effects by depleting calcium and magnesium.
- **Carbon Monoxide (CO):** This colorless, odorless gas is released during the incomplete combustion of battery materials. Inhaling it can cause headaches, nausea, confusion, and chest pain by restricting oxygen flow in the body. At high levels, it can lead to unconsciousness and death.
- **Hydrogen Cyanide (HCN):** Also found in the smoke from battery fires, HCN is a fast-acting asphyxiant that interferes with the body's ability to use oxygen. It can affect the respiratory, cardiovascular, and neurological systems, causing gastrointestinal irritation, and, at toxic levels, can be fatal.
- **Carbon Dioxide:** While not as toxic as the other gases listed, high concentrations can cause headaches, dizziness, and difficulty breathing.
- **Volatile Organic Compounds (VOCs):** These include chemicals like benzene, which can irritate the eyes and throat and, with prolonged exposure, increase the risk of certain cancers.

Particulate matter and health effects

- **Toxic heavy metals:** The cathodes of many lithium-ion batteries contain heavy metals, such as cobalt, nickel, and manganese. During a fire, these are released into the air as microscopic particulate matter (PM2.5) that can be inhaled deeply into the lungs.
  - **Respiratory damage:** Inhaling these particulates can cause airway constriction, lung inflammation, and long-term respiratory issues, similar to exposure from other combustion sources like diesel exhaust.
  - **Systemic effects:** These heavy metals can accumulate in the body, potentially causing neurological problems and damage to other organ systems like the kidneys and liver.
  - **Carcinogenic risk:** Some compounds, like those containing cobalt, are classified as possible human carcinogens.
- **Soot and ash:** The black carbon and residual soot released by the fire can also contain these heavy metals and fluoride, causing significant lung toxicity.