

# Safety Advisory

## Dangers of Unspent Aircraft Oxygen Generators

U.S. Chemical Safety and Hazard Investigation Board



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### Key Message

This Safety Advisory is issued to alert aircraft maintenance and hazardous waste facility personnel to the hazards associated with the transportation and storage of expired, unspent aircraft chemical oxygen generators. Aircraft oxygen generators are dangerous devices that, if mishandled, can cause fires, property damage, and personal injury. Aircraft oxygen generators that have exceeded their service life should be expended before shipping by any transport mode.

### Introduction

On October 5, 2006, at about 10 pm, a fire occurred at the EQ Industrial Services (EQ) hazardous waste treatment, storage, and disposal facility in Apex, North Carolina. The fire resulted in the evacuation of thousands of Apex residents and the complete destruction of the hazardous waste building at EQ's Apex facility. The U.S. Chemical Safety and Hazard Investigation Board (CSB) investigation concluded that aircraft oxygen generators most likely contributed to the rapid spread of the fire to other areas in the EQ facility.

The CSB issues this Safety Advisory to focus attention on the need for aircraft maintenance facilities to expend chemical oxygen generators that have exceeded their service life, and for hazardous waste facility operators and shippers to exercise due care when handling unspent chemical oxygen generators.

### Incident Description

At about 10 pm on October 5, 2006, a citizen driving past the EQ facility in Apex, North Carolina, called 911 when he saw a plume of smoke and smelled a strong chlorine odor coming from the facility. Firefighters arrived minutes later and saw a small fire in one of the hazardous waste storage bays. The fire quickly spread to the adjacent bay containing many 55-gallon drums of flammable solvents. Ultimately, the fire resulted in the complete destruction of the hazardous waste building at EQ's Apex facility.

The CSB found that the initial small fire<sup>1</sup> observed by firefighters was in the same location as a fiberboard container of unspent aircraft oxygen generators and containers of solid chlorine-based pool chemicals awaiting final disposal.<sup>2</sup> Figure 1 shows an oxygen generator found in the fire debris with its activation pin in place, indicating that it was unspent when the fire started. Because oxygen generators were located at or near the origin of the fire and, when actuated or exposed to fire, produce oxygen that significantly increases the intensity of a fire, the CSB concluded that the oxygen generators most likely contributed to the rapid spread of the fire to the area where flammable hazardous wastes were stored.

The unspent oxygen generators found at the EQ facility came from an aircraft maintenance facility. The aircraft maintenance personnel had removed the generators<sup>3</sup> from aircraft and placed them in the packaging used for the new generators installed in aircraft. The aircraft maintenance facility placed the



Figure 1 – Oxygen generator with actuator circled

<sup>1</sup> The cause of the initial fire is unknown.

<sup>2</sup> Based on interviews the CSB conducted with first responders and facility personnel.

<sup>3</sup> The oxygen generators were removed because they were at the end of their useful service life.

packaged, unspent generators in steel drums and shipped them to a hazardous waste facility. The receiving hazardous waste facility misidentified the oxygen generators as a general oxidizer waste on shipping documents<sup>4</sup> they prepared for aircraft maintenance facility.

The receiving hazardous waste facility removed the generators from the steel drums, repackaged them in a one cubic yard fiberboard box, and shipped the box to the EQ facility in North Carolina. This shipment was also incorrectly identified as a general oxidizer waste.

## Background

Most commercial passenger aircraft use chemical oxygen generators to provide passengers with emergency supplemental oxygen in the event of a high altitude cabin depressurization. The chemical oxygen generators, housed in metal cans, include an activation device, chemical core, and oxygen outlet. Pulling the activation pin releases a spring-powered striker that ignites a small explosive inside the generator, initiating an exothermic chemical reaction that generates oxygen.<sup>5,6</sup> As the reaction progresses through the sodium chlorate core, the surface temperature of the metal cylinder can reach 450 to 500°F.

Chemical oxygen generators have a limited useful life, after which they must be replaced. Even when they have exceeded useful life, expired oxygen generators can still be actuated and are still hazardous. Because the generators contain an explosive device, a sodium chlorate oxidizer, and sometimes small amounts of other hazardous materials U.S. Department of Transportation (DOT) regulations classify oxygen generators as a hazardous material. DOT shipping regulations pertaining to all modes of transport require that oxygen generators be equipped with two means of preventing unintentional activation. DOT regulations also forbid shipping unspent and spent oxygen generators on passenger airplanes or trains.

In a 1997 report, The National Transportation Safety Board (NTSB) identified the probable cause of the crash of ValuJet flight 592 in 1996 as a fire in the cargo compartment “initiated by the actuation of one or more oxygen generators being improperly carried as cargo.” The ValuJet flight 592 crash resulted in the death of all 110 passengers and crew onboard. The NTSB, in its findings, stated, “Given the potential hazard of transporting oxygen generators and because oxygen generators that have exceeded their service life are not reusable, they should be actuated before they are transported.”

## Information Resources

The following references include additional information on the safe transportation and disposal of aircraft oxygen generators:

- Aircraft maintenance manuals and instructions.
- Oxygen generator Material Safety Data Sheet (MSDS) included with new generators.
- National Transportation Safety Board (NTSB), 1997. Aircraft Accident Report, In-Flight Fire and Impact with Terrain, ValuJet Airlines, Flight 592, DC-9-32, N904VJ, Everglades, Near Miami, Florida, May 11, 1996, Report No. NTSB/AAR-97/06(PB97-910406), August 1997.
- U.S. Department of Transportation (DOT), 2006. Hazardous Materials Regulations, 49 CFR Subchapter C, DOT.

### **The CSB is issuing this Safety Advisory to**

- **stress the importance of the NTSB finding that oxygen generators that have exceeded their service life are not reusable and should be actuated before they are transported,**
- **alert aircraft maintenance facility operators of the need to actuate and expend discarded chemical oxygen generators in accordance with recommended practices, and**
- **urge aircraft maintenance and hazardous waste facility operators to alert personnel to the hazards associated with unspent generators, and to review DOT regulations governing their shipment.**

<sup>4</sup> Uniform Hazardous Waste Manifest, OMB No. 2050-0039

<sup>5</sup> Exothermic chemical reactions produce heat.

<sup>6</sup> Exposure to high temperatures can also initiate the exothermic chemical reaction in the generator core.