

# Antares ORB-3 Mishap Environmental Update

## As of December 8, 2014

The Virginia Commercial Space Flight Authority (VCSFA), Orbital Sciences Corporation (Orbital), and NASA are working diligently to investigate the environmental impacts of the October 28, 2014 Antares ORB-3 mishap. The mishap occurred on Pad 0-A at the Mid-Atlantic Regional Spaceport owned by VCSFA. The 7 acre Pad 0-A site is located on the south end of Wallops Island. Orbital and VCSFA are responsible for the environmental investigation and cleanup, with support from NASA. The Virginia Department of Environmental Quality, Virginia Department of Health, United States Environmental Protection Agency, and other federal and state agencies have been providing oversight.

***Sampling results to date indicate that most environmental impacts are confined to Pad 0-A.***

### **What Chemicals Did the Antares Rocket and Cygnus Spacecraft Contain?**

The Antares ORB-3 was a two stage rocket. The first stage used the liquid propellants liquid oxygen (LOX) and RP-1. LOX is pure oxygen gas stored at very cold temperatures. RP-1 is a highly refined kerosene, which is similar to home heating kerosene. The Antares ORB-3 second stage contained a solid propellant consisting of ammonium perchlorate, aluminum powder, and a rubber-like binder similar in consistency to a pencil eraser. Immediately following this mishap, the main combustion byproduct of concern from the solid propellant was hydrogen chloride (HCl) gas. In the longer term, the main product of concern resulting from breakdown of this type of solid propellant in the environment is perchlorate, which can dissolve in water.

The Cygnus spacecraft used liquid anhydrous hydrazine and dinitrogen tetroxide for its propellant system. While these two substances are known to be very hazardous in their liquid or vapor forms, they rapidly react in air, soil and water to form other nonhazardous compounds and dissipate quickly.

All of the propellants onboard Antares and Cygnus are commonly used by the aerospace industry at launch sites in the U.S. and abroad. For more information on these types of propellants please see the Kennedy Space Center Propellants Fact Sheet (<http://www-pao.ksc.nasa.gov/nasafact/count2.htm>).

### **What Sampling and Observations Have Been Completed?**

**Air:** The Wallops Fire Department performed air monitoring on Wallops Island beginning immediately following the mishap until three days after. A NASA industrial hygienist collected ten air samples within one hour of the incident, including sites to the west on the Mainland, Chincoteague causeway bridge, and Chincoteague Island.

**Surface Water:** The U.S. Coast Guard and Virginia Marine Resources Commission patrolled the inland bays and ocean for 24 hours following the mishap and reported no observations of water pollution, such as oil sheens. On October 29, water samples were collected near storm water outfalls along the inland bays downwind of Pad 0A where the mishap occurred. On October 31, surface water samples were collected near outfalls along Cat Creek and Hog Creek west of Pad 0-A, and from the retention basins inside Pad 0A. A larger surface water sampling effort, targeting areas in the wetlands where debris had fallen, and from ponds and ditches on Wallops Island, ended November 17.

**Groundwater:** On October 31, groundwater samples were collected from the impact crater. Additional samples were collected on November 13, 14, and 21.

**Soil:** On November 6, soil sampling in the Pad 0-A impact area was completed. On November 17, a larger sediment/soil sampling effort, targeting areas in the wetlands where debris had fallen, was completed .

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### What Is Known So Far About the Environmental Impacts?

Location	Air	Surface Water	Groundwater	Soil
Impacts inside Pad 0-A	No	Yes Cleanup Completed	Yes Cleanup Underway	Yes Cleanup Underway
Impacts to Wallops Island and wetlands	No	No*	TBD**	No*

\*Based on preliminary results. Further assessment required for final determination.

\*\*Future groundwater investigation will be performed.

**Air:** Air sampling did not detect HCl, anhydrous hydrazine, or dinitrogen tetroxide in any of the locations sampled.

**Surface Water:** Water sample results show RP-1 and perchlorate present in the retention basins and standing water against the seawall inside the Pad 0-A site.

**Groundwater:** The impact crater results show RP-1 and perchlorate present. The impact crater is filled with groundwater. However, this groundwater is not a drinking water source. Additionally, there is a substantive clay layer about 15 feet beneath Pad 0-A, which will prevent RP-1 and perchlorate from migrating deeper.

**Soil:** The soil sampling results show RP-1 present in the soil around the impact crater, at the state regulatory limit. Perchlorate was only found in the soil near the impact crater at levels well below federal and state limits.

### What Actions Are Being Taken with Regards to Environmental Impacts?

**Air:** No further action is required since no hazards or environmental impacts were identified during sampling.

**Surface Water:** The retention basins have been pumped dry. The basins will be cleaned to prevent future contamination. The standing water inside the Pad 0-A site has been pumped.

**Groundwater:** The impact crater was pumped dry 5 times to remove significant levels of perchlorate. Pumping will continue to remove as much RP-1 and perchlorate as possible to mitigate long term groundwater impacts. Water samples are being taken from the impact crater after each pumping to track progress. Pumped water is being stored in large, enclosed tanks and will be transported to a permitted, off-site treatment facility. Orbital and VCSFA will work with federal and state agencies to develop a groundwater investigation strategy to determine if there are further impacts to the groundwater.

**Soil:** Soil will be excavated around the impact crater to remove any residual RP-1. The soil will be hauled to a permitted, off-site disposal facility. Once this soil is removed, environmental impacts to the soil will have been eliminated.

The community will continue to be informed as these efforts move forward. Feel free to contact Jeremy Eggers of the Wallops Office of Communications at (757) 824-2958 or [jeremy.l.eggers@nasa.gov](mailto:jeremy.l.eggers@nasa.gov) if you have any questions, comments, or concerns.