

Cryogenics Test Laboratory

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To many Floridians, freezing temperatures are a bad thing.

To the Cryogenics Test Laboratory at the Kennedy Space Center, the application of extremely low temperatures is a powerful, albeit potentially hazardous, tool. The lab provides research, development, and testing for cryogenic systems, components, thermal insulation, sensors, and instrumentation—for both NASA and the commercial sector. The lab focuses, however, first and foremost on safety.

After watching this video, you should be able to describe the primary hazards you may encounter at this laboratory as well as its access procedures and general safety requirements. This video will not qualify you to work with cryogenic fluids or pressurized systems.

Part of KSC's Cryogenics Testbed, the Cryogenics laboratory is located just south of the Launch Equipment Test Facility in the Industrial Area.

Guests are welcome but please contact the facility manager before visiting the laboratory. When you arrive, you'll need to enter through the front door and sign the guest register. Please check in with lab personnel. Visitors should be accompanied by a lab employee at all times.

The facility includes three laboratories, a high bay, clean room, and offices. The first potential hazard you may notice is an exhaust trench that runs through the facility to vent cryogenic fluids. Most of the time this trench will be covered with metal plates; however, from time to time, it may be uncovered for maintenance. In that case, the trench will be roped off and properly barricaded.

The primary hazards found in this facility are cryogenic fluids and pressurized systems.

A cryogenic fluid is a liquefied gas with a boiling point below -130 degrees Celsius. The lab primarily uses liquid nitrogen. Its boiling point is -196 degrees Celsius (or -320 degrees F.) No flammable or oxidizing cryogenic fluids, such as liquid hydrogen or liquid oxygen, are used in this particular facility.

Extreme cold is the most obvious danger of any cryogenic fluid. Brief exposure may result in a contact burn or frostbite. You should never touch the liquid itself, or uninsulated pipes, or other cryogenic equipment with your bare hands. You should always wear dry cryogenic or leather gloves, a face shield, and an apron when handling cryogenic materials. The face shield is essential because your eyes are particularly sensitive to cryogen exposure, even to the cold vapors. Exposure that may not cause damage to your skin may cause permanent damage to your eyes.

If you do come in contact with liquid nitrogen, rinse the affected area thoroughly with gently flowing cold water. The lab has an emergency shower and eye wash for this purpose. Depending on the severity of the exposure, call 911 or report to the Occupational Health Facility for medical treatment.

Not only are cryogenic fluids extremely cold but they also vaporize rapidly at room temperature. When released into the air, liquid nitrogen quickly expands. In a confined or poorly ventilated space, released nitrogen can displace the oxygen in the air, which can cause asphyxiation. Portable oxygen monitors are in use throughout the facility. If the oxygen content falls below the minimum acceptable level of 19.5%, an alarm will sound. Evacuate the building until the 'all clear' is given.

The other primary hazard in the facility is its pressurized systems, which supply the lab with nitrogen and helium. These systems include cryogenic Dewars, K-bottles, flex hoses, valves, and regulator panels. All of these components contain gas or liquid under high pressure—that is, a pressure of 150 pounds per square inch or greater. The release of that pressure—because of a rupture, loose fitting, or mistakenly opening a system thought to be depressurized—can be fatal. However, the most common injury when working with pressurized systems results from improperly restrained flex hoses. If these hoses are not properly weighted down or clamped and their ends are not restrained, they can whip around, damaging equipment and injuring personnel. All flex hoses pressurized to 150 pounds per square inch (or higher) need to be properly restrained with 100 pounds of weight every six feet.

The facility also includes a Class 100 Clean Room. A clean room is a controlled environment where humidity, temperature, and particulate matter are precisely controlled to a specific limit. A Class 100 Clean Room, for instance, cannot have more than 100 particles per cubic foot of air. A typical office building has between 300,000 to 1,000,000 particles per cubic foot of air. Therefore, stringent procedures must be followed in order to prevent clean room contamination. Access must be approved by the facility manager. A full clean room suit—including coverall, hood, and boots—are required for entry. Follow the posted and written procedures for entry and exit.

A general safety rule in any laboratory is not to touch, disturb, or activate anything with which you are not familiar or have not been given authorization to use. For example, the Cryogenics lab has a facility vacuum system. Though it is not particularly hazardous to personnel, improper usage of the system could severely damage it.

In case of emergency, such as a fire or oxygen depletion, exit the facility and proceed to the marshalling area. It is located on the west side of the Development Integration Laboratory.

To recap, here's what you need to know about the Cryogenics Test Laboratory::

- When visiting the lab, please sign in and check in with lab personnel. A lab employee must escort all visitors.
- The lab's primary hazards include cryogenic fluids and pressurized systems.
- Cryogenic fluids pose two major health and safety threats: extreme cold and asphyxiation.
- Key safeguards include portable oxygen monitors, emergency shower, and eyewash.
- The marshalling area is located west of the Development Integration Laboratory.

Also, please bear in mind that proper training is required to handle cryogenic fluids and work with pressurized systems. This video is not intended to qualify you to do either.

The Cryogenics Test Lab may be a cutting-edge research and development facility, but its number-one core value is safety.