

Guidance for the Evaluation of Method Statements for Cold Work

What is a Cold work?

Cold work is any work that involving the maintenance, installation or inspection of plant which contains liquefied gasses at sub-zero temperatures, in this guidance cryogenic temperatures are defined as those below 120 K (-153°C).

Hazards in Cold Work

Cold contact burns - Liquid or low-temperature gas from any of the specified cryogenic substances will produce effects on the skin similar to a burn.

Asphyxiation - Degrees of asphyxia will occur when the oxygen content of the working environment is less than 20.9% by volume. Effects from oxygen deficiency become noticeable at levels below ~18% and sudden death may occur at ~6% oxygen content by volume. This decrease in oxygen content can be caused by a failure/leak of the cryogenic vessel or transfer line and subsequent vaporization of the cryogen.

Explosion – Pressure - Heat flux into the cryogen from the environment will vaporize the liquid and potentially cause pressure build-up in cryogenic containment vessels and transfer lines. Adequate pressure relief must be provided to all parts of a system to permit this routine outgassing and prevent explosion.

Explosion – Chemical - Cryogenic fluids with a boiling point below that of liquid oxygen are able to condense oxygen from the atmosphere. Repeated replenishment of the system can thereby cause oxygen to accumulate as an unwanted contaminant. Similar oxygen enrichment may occur where condensed air accumulates on the exterior of cryogenic piping. Violent reactions, e.g. rapid combustion or explosion, may occur if the materials which make contact with the oxygen are combustible.

Precautions for Cold Work

As a **minimum** the following precaution should be applied to all cold work;

1. All Cold work must be subject to the University's Permit to Work System; no other local arrangements or contractors systems should be accepted. There permit must not be issued until a suitable and sufficient risk assessment and safe system of work has been supplied by the company or individuals undertaking the work. This should be reviewed by the Estates and Health and Safety Manager
2. The whole activity should be supervised by an individual who has the responsibility to ensure that all of the necessary precautions are implemented and must have received training in cold work precautions.
3. During the work personal oxygen monitors should be used to ensure that the oxygen in the area is sufficient to support personnel working in the space, this should be undertaken using calibrated oxygen monitoring equipment and the results should be recorded. Certificates confirming their calibration should be sought.
4. The isolation of cryogenic gasses and liquids that could flow into the space. Isolation requires the physical disconnection of services in such a way that they cannot be accidentally reconnected. This will usually require using blanking plates, closing and locking off valves or disconnecting and removing pipe work leading to the space. Any devices used to lock off valves should only be removable by those working in and controlling the space.
5. Isolation of mechanical and electrical equipment. Isolation requires the physical disconnection of the flow of power to the equipment in such a way that they cannot be

accidentally reenergised. This will usually require isolation and locking off of the plant at the distribution board or at the local isolation switch. Any devices used to lock off equipment should only be removable by those working in and controlling the space.

6. All smoke and heat detectors within the vicinity of the work should be protected with proprietary covers to prevent accidental fire alarm activation. Before covering detectors the Building Supervisor must be notified and covers for fire detectors must be removed at the end of each day.
7. Suitable lighting should be available during the task where work is undertaken during night times. This can be either from existing lighting in the area or supplementary lighting installed during the task. In either case emergency lighting should be available to aid escape in the event of a power failure.
8. The wearing of Personal Protective Equipment (PPE) such as overalls, safety footwear, gloves, safety helmets and dust masks. Consideration should be given the specification of PPE to be temperature resistant during cold work activity.

PPE - Whenever handling or transfer of cryogenic fluids which could result in exposure to the cold liquid, boil-off gas, or surface, protective clothing shall be worn. This will include:

face shield or safety goggles, safety gloves long-sleeved shirts, work coats, aprons.

Eye protection is required at all times when working with cryogenic fluids. When pouring a cryogen, working with a wide mouth dewar or around the exhaust of cold boil-off gas, use of a full face shield is recommended.

Hand protection is required to guard against the hazard of touching cold surfaces. Loose insulating gloves can be used.

Further Guidance

Further Guidance on safe working with Cryogenic material can be sought from The Safety and Risk Management Team.