

# Exposure to Very Cold Liquefied Gases

This guidance note details the adverse health effects of contact with very cold liquified gases and the recommended treatment.

The temperatures of liquified gases vary. The boiling points, i.e. the temperature at which the commoner liquid gases vaporise, are as follows:

**Helium - 268°C Argon - 185°C Ethylene - 103°C  
Nitrogen - 195°C Oxygen - 183°C Propane - 42°C**

## General Effects on Human Tissue

The effect of extreme cold on tissue is to destroy it, a similar end result to that of heat exposure. The degree of cold and the duration of contact determine the extent of the injury. The destruction of tissue is less obvious than in the case of burns since pain is absent in the frozen stage and the frozen tissue keeps its normal shape. Severe pain and tissue destruction become apparent as thawing occurs. Prevention of contact with very cold liquids is essential and those who work in this field must be aware of the hazard and the measures necessary to minimise the risk.

## Skin Effects

Liquid vapour, or low temperature gas can produce effects on the skin which will vary in severity with temperature and the duration of exposure. Naked or insufficiently protected parts of the body coming into contact with un-insulated pipes or vessels may stick fast by virtue of the freezing of moisture, and flesh may be torn in removal. For this reason, the wearing of wet clothing should be avoided. Continued exposure of naked flesh to cold atmospheres can result in frostbite. Pain is usually sufficient to produce warning while the freezing process is taking place. Re-warming at 42-44°C (lukewarm water) will generally safeguard against injury.

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## Treatment of Cold Contact Burns

1. If the area is large or deeply frozen, take the patient to hospital or send for an ambulance. Start treatment while waiting for ambulance.
2. Remove any clothing that may constrict the circulation to the frozen area.
3. As soon as possible immerse the part of the body exposed to the cryogenic material in a bath or basin containing tepid water at a temperature of 42-45°C (the water temperature should be a little warmer than body temperature). It is better to err on the side of cooler water rather than too warm. Never use dry radiant heat which will superimpose a burn upon the frozen tissues. This can occur because blood is not flowing through the frozen part and the capability of conducting heat away from the warmed part does not exist. The intention is to allow slow warmth to penetrate from the outside.

4. In the unlikely event of massive exposure to the super-cooled liquid so that the general body temperature is depressed, the patient will need re-warming by immersion in a tepid bath. Shock may occur during re-warming.

5. Frozen tissues are painless, and appear waxy with a pallid yellowish colour. They become painful, swollen and prone to infection once thawed. Thawing may take from 15-60 minutes and should be continued until the colour of the skin turns from pallid yellow to blue and then to pink or red.

6. When the frozen part of the body has thawed cover the area with dry sterile dressings with a large protective covering.

7. Alcoholic beverages and smoking decrease blood flow to the frozen part and are contra-indicated.

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## SUMMARY

SKIN CRYOGENIC BURNS  
DO THAW SLOWLY IN LUKEWARM WATER  
DO COVER THAWED PART WITH STERILE DRESSING  
DO SEEK MEDICAL HELP IF AREA OF FROZEN PART IS EXTENSIVE  
DO SEEK MEDICAL HELP IF FROZEN PART IS DEEPLY FROZEN  
DO NOT REMOVE ADHERENT CLOTHING UNTIL THAWED THOROUGHLY  
DO NOT THAW IN HOT WATER OR EXPOSE TO RADIANT HEAT SOURCE  
DO NOT GIVE ALCOHOL OR ALLOW SMOKING  
LUNG COLD INHALATION INJURY  
IF EXPOSED TO VERY COLD GAS BY INHALATION SUFFICIENT TO CAUSE DISTRESS, SEND TO HOSPITAL

This database is updated and maintained by the Group Occupational Health Department at BOC Gases, Guildford