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## Hot Cutting Operations

### Introduction

Hot cutting operations are an integral part of a rescue capability within the urban environment. A hot cutting capability allows trained operators to penetrate and cut ferrous and non-ferrous structural members, cut reinforcing rods and cables, and remove metal fittings such as bolts and hinges.

The USAR capability uses two hot cutting systems:

- Petrogen Oxy-Fuel Cutting system
- Clucas Thermal Arc Back Pack system

The two systems complement each other with differing performance standards depending on the metal being cut and the environment in which the cutting operation is taking place. Full details are provided in the USAR Equipment Notes issued with the appropriate USAR module.

### Scope

This document details the general arrangements for hot cutting operations including safety precautions and emergency arrangements.

### Sequence of Activities

The following sequence of activities should be followed when hot cutting operations are being considered or undertaken:

- Risk assessment
- Selection of system of work
- Preparation
- Cutting operation
- Making-up

### Risk Assessment for Hot Cutting Operations

An assessment must be carried out that will take into consideration:

- Information on the location and number of trapped victims (if any)
- The state of the structure in the area of hot cutting operations. This will identify structural elements, hazards such as loose or hanging debris, the loading of structural elements and the potential for further collapse
- The nature of the material to be cut, including its composition and any covering material such as paint, fire retardant or chemical coating
- The nature of the debris or material adjacent to the site of hot cutting operations – flammable, likely to give off fumes if heated etc.

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- The location of the cutting operations – confined space, limited ventilation, above or below ground level etc.
- The presence or otherwise of flammable or toxic gases or fumes
- The ease of access and the nature of the ground underfoot – loose debris, hard standing, the presence of standing water etc

After the assessment, the appropriate hot cutting equipment is chosen and a system of work selected. Any specific mitigating actions identified by the risk assessment must be put in place before hot cutting operations begin.

### System of Work Selection

Where an assessment has identified that a particular part of a structure requires cutting, the type of the equipment to be used and the type and location of the cut must be decided.

There are common procedures that must be followed in most situations. These are:

- A minimum of two USAR technicians trained in hot cutting techniques are required to ensure safe operation of the chosen equipment. They are termed the 'torch operator' and the 'safety operator'.
- Both operators must wear the correct PPE specifically supplied for hot cutting operations over normal USAR overalls (with the sleeves rolled down). This includes a leather jacket, trousers, spats to protect the boot area and welding gloves. A helmet must also be worn with a fire hood protecting the neck area. Eye protection is provided by welding goggles.



Figure 1 [SOP\_RES001]  
Correct PPE for Hot Cutting Operations

- RPE is not necessary in normal operating environments as the equipment must only be used where adequate ventilation is present. If ventilation may not be sufficient, consider using forced ventilation fans and ducting.
- Use of an anemometer will ensure a flow rate of 2 metres per second can be maintained. Safety operators must be aware of the hazard created downwind of cutting operations and take appropriate action.

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- Safety operators must monitor the atmosphere before and during operations to ensure that an irrespirable atmosphere is not being created. The use of a 4-gas monitor (Zellwegger) will be sufficient, maintaining the oxygen content of the atmosphere being the most important. Safety operators must also monitor carbon monoxide levels, as burning operations will increase the amount of this gas.
- If sufficient ventilation cannot be maintained, it may be advisable for both operators to use self-contained or airline breathing apparatus.
- Cutting operations should not take place in a confined space.
- Torch operators should use the correct tip for the job and keep the cutting flame as short as possible. The cutting flame should be extinguished once work has been completed.
- A hazard zone appropriate to the risk should be set up around the work area. The use of traffic-tape or physical barriers should be considered.
- All personnel involved must be fully briefed.
- Cutting operations can produce a fire hazard and radiant heat transfer. Therefore safety operators must ensure an extinguisher or charged hose is available
- An additional observer monitoring the safety of the hot cutting team and others that the hot cutting operations may affect should be considered
- If cutting operations are being undertaken close to a casualty, a form of shielding and an observer to monitor the casualty must be considered. A heat resistant blanket is provided for this purpose.

### Preparation for Hot Cutting Operations

Once the equipment to be used and a system of work have been selected, the location, equipment and the material to be cut must be prepared.

- The area of operations must be well ventilated, safe from secondary collapse or falling debris and secure underfoot.
- Atmospheric monitoring must be in place.
- The selected equipment must be transported to the workplace. Petrogen is transportable on its own trolley and the Clucas has a backpack system. Detailed information regarding equipment setup is provided in the USAR Equipment Notes issued with the appropriate USAR module.
- Coatings or coverings likely to cause a hazard during cutting operations (grease, rust, concrete dust or debris etc.) should be removed from the material to be cut before cutting operations commence.
- Cuts should be planned – consider marking the material to indicate the line of cutting.

### Hot Cutting Operations

The Petrogen Oxy-Fuel Cutting System is able to cut through steel and other metals up to 31cm (12") thick. It can cut layers of metal with air gaps between them and operates successfully in water, dust and other USAR environments.

Petrogen duration: a "W" Type oxygen cylinder will last 45 – 60 minutes with a No 5 tip, using approximately 3 litres of fuel.

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The Clucas Thermal Arc Back Pack cutting equipment is designed for the cutting of ferrous metals only, but due to the high flame temperature of 2,500°C it will also melt a large variety of other materials.

Each cutting rod provides a maximum cutting time of 1-2 minutes and the contents of the Clucas oxygen cylinder provides approximately 12 minutes duration cutting time.

Detailed information regarding specific cutting operations is included within the relevant operational guidance notes.

### **Making-Up**

The material cut should be cooled to ensure there is limited opportunity for ignition of the surrounding area or material.

### **Emergency Arrangements**

The safety operator is responsible for initiating emergency arrangements.

In the event of a secondary fire, ventilation problems, structural movement, equipment failure or other emergency, hot cutting operations must stop immediately. The operators will withdraw and a further risk assessment will determine if any additional control measures are required, or if a different system of work is more appropriate.

### **Limitations of the Hot Cutting Systems**

The Petrogen Oxy-Fuel Cutting System will not cut stainless steel and some cast irons.

Cutting galvanized steel generates toxic fumes and should be avoided, use B.A and refer to Risk Assessment.

Neither system is recommended for use in confined space or for working at height when the operator is in suspension.

### **References**

Thermal Arc Back Pack Operators Manual

Petrogen Reference Manual

BS 6187:2000

WL14 - COSHH Essentials for Welding, Hot Work and Allied Processes

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