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Target Audience:

All FOD Staff

INVESTIGATION OF RIDDOR 6(1) DOMESTIC GAS INCIDENTS

This OC advises inspectors of the arrangements for the reporting and investigation of RIDDOR 6(1) gas incidents, the role of investigators working on behalf of gas suppliers and gas transporters, and liaison with police and coroners. It does not include matters relating to investigations that are dealt with in other procedures and guidance.

INTRODUCTION

Reporting of Incidents - RIDDOR

1 Incidents attributable to either carbon monoxide poisoning or fires/explosions from the ignition of gas are reportable to HSE under RIDDOR reg 6 (1). RIDDOR reg 6(1) applies when someone has died or suffered a major injury in connection with gas, unless the incident was reportable under RIDDOR reg 3 (1) (e.g. in the course of employment).

2 For CO exposure, the relevant major injury conditions are:

- a) An injury requiring resuscitation or admittance to hospital for more than 24 hours.
- b) Loss of consciousness caused by exposure to CO.
- c) Acute illness requiring medical treatment resulting from inhalation of CO.

Acute illness means illness which:

- i. Progresses rapidly to a crisis after the onset of symptoms; and
- ii. Has severe symptoms.

Medical treatment covers hospital treatment, and treatment by a GP.

2 Reports to the Incident Contact Centre (ICC) will generally be made by Transco (as the gas conveyor or as the emergency service provider acting on behalf of independent conveyors) within 2 hours of attending the incident, or very occasionally by LPG suppliers.

3 LPG incidents may not be reported initially by the LPG supplier (the dutyholder), as they may not be aware of the incident. In some cases it may not be possible to identify the supplier. Where inspectors are informed of incidents, e.g. by the police, they should wherever possible contact the gas supplier and ask them to report the incident to the ICC. For deaths, where the supplier cannot be identified, contact the Utilities Section of CACTUS, who will make the report.

Duties Under Gas Safety Management Regulations (GSMR)

4 GSMR places duties on gas transporters and suppliers to investigate certain downstream natural gas incidents.

- a) Gas escapes from gas fittings on domestic premises that have resulted in a fire or explosion (i.e. not just those where there have been deaths or major injuries). The conveyor immediately upstream of the emergency control valve at the premises should investigate to establish whether the escape was from installation pipework or from an appliance.
- b) RIDDOR 6 (1) incidents that have arisen as a result of an escape of carbon monoxide (CO) from incomplete combustion of gas in a fitting. The gas transporter is required to notify the gas supplier of such incidents. The gas supplier should investigate to establish so far as is reasonably practicable the cause of the escape and accumulation of CO.

5 There may be occasions where there is a conflict of interest, e.g. an installer employed by the gas supplier has recently done work on an appliance in the property concerned. Where such circumstances apply, it has been agreed with suppliers, that they will use an independent investigator to carry out the GSMR investigation. If an inspector hears of an investigation where this agreement has not been followed, they should send details to the Utilities Section.

6 Gas conveyors and suppliers need to have in place the following arrangements for carrying out these investigations:

- a) Ensure that individuals who carry out investigations are competent;
- b) Notify HSE before any investigation required by GSMR begins, this will usually be via a phone call to the local area office. This is to ensure that evidence is not disturbed before HSE has decided whether it will investigate the incident. In this instance, 'notify' goes beyond what is required by RIDDOR; and

- c) Whether HSE carries out an investigation or not, the conveyor/supplier must ensure that a report of their investigation is sent to HSE. This should set out:
 - i. A brief description of the incident,
 - ii. Details of the causal factors and
 - iii. Any remedial action taken or proposed.

7 Reports by gas conveyors into fires and explosions will be sent electronically to HID and rerouted to the relevant FOD office.

8 It has recently been agreed with the major investigators of CO incidents that where an incident does not involve a death and there is no dutyholder implicated it can take the form of a downstream incident data report (DIDR) accompanied by a brief description of the incident. The DIDR provides information on all CO incidents involving natural gas (it can also be used for LPG investigations) to a database managed by Advantica, currently on HSE's behalf. Regular analysis of this data shows trends in causation, appliances etc which are used to inform research, standards and practice.

Carbon Monoxide Incidents

9 It can be difficult initially to establish whether CO was the cause of the death or injury and the gas transporter may make reports that are not later substantiated. Under current licence conditions issued by Ofgem, Transco engineers do not have to spend more than half an hour on site when responding to emergency call outs. Thus they may not fully investigate the alleged source of CO or have access to all relevant information at the time they attend. Local offices are encouraged to build up contacts with hospitals so that they can obtain confirming information – where necessary medical inspectors may assist. Gas suppliers may also want confirmation before committing themselves to the expense of an investigation. If the incident has resulted in fatal injuries the Coroner's Officer should be able to confirm CO poisoning.

10 Carbon Monoxide is colourless, odourless, tasteless and non-irritant. It combines with the haemoglobin in the blood to produce carboxyhaemoglobin (COHb).

11 Symptoms in humans are related to carboxyhaemoglobin levels. The table in Appendix 1 uses the Coburn-Forster-Kane equation (Coburn RF, RE Forster and PB Kane, 1965) to extrapolate the carboxyhaemoglobin values to approximate atmospheric CO levels, for a **single** 8-hour or 15-minute exposure, assuming a moderate level of activity.

12 Symptoms are shown in the table for various levels of exposure. Smokers average 5% to 7% COHb. Non-smokers 0.1% to 2.5%.

13 For living persons COHb levels in the blood fall rapidly when exposure ceases. So blood tests should be taken promptly. For example 4 hours after exposure COHb

may have reduced by up to 50%. For deceased persons COHb levels persist after death.

Fires and Explosions

14 Fires and explosions can often either completely or partially destroy relevant evidence. This can occur as a result of the fire/explosion itself or sometimes, as an inevitable consequence of the emergency services work.

15 The police almost always call out Transco to these incidents. It will often be unclear initially whether the source of the explosion is from the distribution network and for HID to investigate, or from the pipework in the premises in which case it falls to FOD. Until the source is established it has been agreed that FOD will make initial contact or attendance (see OC 440/28).

16 Inspectors should make contact with the Transco engineer on site (or who attended site) for further information.

17 When buildings have been damaged by fire or explosion, advice about building stability may be required before entry – contact SG or the local authority building control officer who deals with dangerous structures.

HSE Investigation

18 FOD investigates those incidents that meet the incident selection criteria – usually those where there is a potential dutyholder and a death or major injury.

19 Gas suppliers and conveyors may nominate others to carry out investigation work for them and, as stated earlier, should certainly do so where there is a conflict of interest. If inspectors consider it appropriate to have an opportunity to look at the incident location first or with the nominated investigator they should contact the gas supplier/conveyor immediately. Although required, it should not be assumed that they will always notify us before initiating investigation work. Thus it is advisable to be proactive in identifying the supplier's investigator at the earliest opportunity. CACTUS Utilities section maintain a list of Gas suppliers contact details and their appointed investigators, current versions have been circulated to operational B2's. See also Appendix 13 of the Gas Guidance document issued to administrative staff who process gas incidents.

20 It is important for investigations to proceed without any undue delay particularly where a householder/tenant is without means of heating/cooking There have been instances where CORGI registered installers have carried out work on an appliance (e.g. at the request of the householder) before the gas supplier's investigation has begun, thus preventing any meaningful investigation. Installers should be aware that where there has been a RIDDOR 6(1) incident they should check with HSE before starting work on an appliance. Unless the work has been a deliberate attempt to interfere with the investigation, the matter should be reported to CORGI for their action.

21 Once a decision has been made to investigate a natural gas incident, reliance can be placed on the supplier's investigation for much of the technical evidence; however it must be understood that they are working to fulfil the statutory duty under GSMR and not specifically under HSE's direction. Therefore, it is advisable to ensure that all parties are aware that the Police/HSE investigation has primacy, and that the suppliers investigation should not adversely effect such investigations. For LPG incidents or if additional technical investigations are required it will be necessary to source these through SG, which has a call off budget with appropriate organisations. HSL now has two CORGI registered staff who can assist when required. **Inspectors must not carry out any work on a gas fitting for which CORGI registration is required.**

22 Fatal incidents will be subject to coroners' enquiries and in many cases the police will also investigate for potential manslaughter considerations. The police and coroners have been advised about the role of the gas supplier's investigator and should be encouraged to make use of their expertise. Inspectors should also refer to the Enforcement Handbook - England and Wales Chapter 12, the work related deaths protocol and associated pack for the bereaved, and (OC 165/9). Inspectors in Scotland should see the Enforcement Handbook - Scotland - Chapters 1, 5 and 9.

23 If the investigation indicates a concern about public safety e.g. a gas installer has demonstrated a pattern of poor work that may be repeated in many locations, then before making any decision about whether they need to take further action inspectors should refer to the advice detailed in (OC 440/35).

Rights of entry

24 Inspectors have the power of entry to private residential property for the purpose of carrying into effect the relevant statutory provisions. Transco also have a right of entry under the Gas Safety (Rights of Entry) Regulations 1996 but only if there is a piped supply of natural gas. HSE inspectors have been given powers of entry in an emergency to facilitate making a supply of LPG safe if required. Entry into domestic premises by an inspector against the wishes of the occupier should be considered only as a last resort and only following consultation with their line manager. Because of the political sensitivities involved the Band 2 may decide to obtain a court order thereby demonstrating that a third party believes such action to be justified – (see OM 2001/117 para 54).

Incident Simulation

25 Simulation testing, by operating the gas appliances in their "as found" condition, is one tool available to investigators. This should only be performed if it is essential to the purpose of the investigation and a risk assessment concludes that it can be done safely. Results of simulation tests are often inconclusive as it can be difficult to recreate all the circumstances and conditions.

26 The decision to carry out a simulation exercise is one for the competent investigator i.e. the gas supplier's appointed investigator or the contractor working for SG. **Inspectors should not initiate or participate in simulations but may**

observe from a safe place.

27 When a simulation is undertaken it will normally be terminated when the level of CO in the centre of the room under test reaches 200ppm. Investigators should be able to calculate likely levels reached after longer periods of time and in varying scenarios and will provide these calculations as evidence if required. This limit has been agreed on both safety and economic grounds. If exceptionally, testing to a higher level is agreed as necessary, then additional safety precautions may be required as identified by risk assessment. **Please see Appendix 2 which outlines key safety information for HSE staff and the industry agreed guidance on simulations.**

Incident Recording

28 Gas safety statistics have a high public profile, particularly in relation to incidents reportable under RIDDOR Reg 6(1). It is important that these incidents, and any enforcement action taken as a result, are recorded as accurately as possible.

29 If the incident later transpires to be non-reportable or the incident should have been reported as an accident at work, please ensure that ICC and FOCUS databases are appropriately amended as soon as possible, e.g. where it is found that a person attended hospital only as a precaution, with no injury confirmed. Changes to the ICC report should be notified to the ICC Incident Officer (IO). The IO will then arrange for the ICC to be informed.

30 Where initial enquiries determine there is no need for further HSE involvement, HSE should monitor the progress of investigations made on behalf of the supplier or conveyor under the GSMR Reg 7(12) and Reg 7(14). These investigations may uncover further information about the circumstances of the incident and occasionally these will indicate, contrary to initial information, that there are grounds for FOD intervention. However, if it is confirmed that HSE involvement is unnecessary then that should be recorded in the comments field on the FOCUS gas event record explaining why no investigation was carried out.

31 In deciding on a cause of death, and thus whether it is reportable, HSE should abide by the coroner's judgement.

32 All gas-related deaths, whether accidental or deliberate, are reportable. This means that suicides are reportable and should be recorded as such. Similarly attempted suicides will also be reportable, if the person has suffered major injury. To ensure that the figures HSE releases give a proper picture, HSE annotates the published figure for gas fatalities to show how many suicides are included. Therefore, Inspectors are asked to ensure that suicides are highlighted, preferably by reference to suicide in the FOCUS events comments field.

Additional Information

33 OC 440/30 provides guidance regarding gas safety enforcement and gas procedures.

OC 440/34 provides information regarding gas safety in caravans.

This OC cannot cover all situations, thus enquiries for further information or advice should be directed to CACTUS, Utilities Section, Nottingham office.

Date first issued: 29/06/2005

APPENDIX 1

% COHb	Equivalent atmospheric CO concentration (ppm)		Symptoms
	8 hour	15 minute	
0.7 - 5	0.1 - 30	0.1 - 300	No clinical signs or symptoms in healthy individuals.
3 - 6	20 - 40	160 - 370	Cardiovascular effects in patients with pre-existing cardiovascular disease: exacerbation of pre-existing exercise-induced angina; ventricular arrhythmia during exercise.
5 - 10	30 - 70	300 - 650	Compensatory increase in blood flow to brain and certain other vital organs.
10 - 20	70 - 135	650 - 1350	Headache; exertional dyspnea.
20 - 30	133 - 200	1350 - 2050	Throbbing headache, nausea, loss of fine manual dexterity and reduced capacity for calculation and discernment.
30 - 40	200 - 270	2050 - 2750	Severe headache, dizziness, nausea, vomiting, fatigue, visual disturbances.
40 - 50	270 - 335	2750 - 3450	Tachycardia, tachypnea, syncope.
50 - 60	335 - 400	3450 - 4150	Coma and convulsions.
60 - 70	400 - 470	4150 - 4850	Respiratory failure and death, if not treated
> 70	> 470	> 4850	Rapidly fatal.

(Coburn RF, RE Forster and PB Kane, 1965)

APPENDIX 2

CARBON MONOXIDE INCIDENTS INVOLVING SIMULATION

All HSE personnel are reminded that there is a risk of possible exposure to Carbon monoxide (CO) during investigation simulations into suspected ill health incidents involving a domestic gas appliance.

HSE Personnel should: -

- a) Under no circumstances participate in (other than by observing from a safe position), give advice on, or participate in the decision making process relating to whether or not a simulation should be carried out.**
- b) Ensure the competent person has done a risk assessment before the simulation takes place.**
- c) Withdraw to a safe area until the simulation exercise is complete.**
- d) Await re-entry to premises until such time as the competent person declares it safe.**

Inspectors who observe simulations must be aware of the hazards associated with the incomplete combustion of gas and should have attended a gas safety training course (either national or local) or be known to have an equivalent level of safety awareness and training.

Line managers should ensure that staff who may be involved in gas incident investigations have had the necessary training and are familiar with the associated risks.

KEY INFORMATION

1 The decision to carry out a simulation is one for the technical investigator/competent person to make dependent upon the circumstances i.e. is it essential and necessary for the purposes of the investigation and can it be done safely (see industry agreed guidance in Appendix A).

2 The simulation should be continued up to a maximum of 200ppm CO in the test area, unless there are exceptional circumstances that warrant higher levels (limit of 700 ppm). This may require additional precautions, which should be specifically considered in the individual risk assessment, including the justification for testing to higher levels.

3 The competent person in charge of the technical investigation should make a site specific risk assessment. This should consider at least:

- a) An evaluation of where CO could accumulate. For example flues, ducts, lofts, attics etc could allow CO to pass to other parts of the

building or adjoining premises. The investigator must keep adequate control of all spaces and rooms where CO may accumulate.

- b) Suitable monitoring equipment should be used including personal monitors set to alarm at 30ppm; remote monitoring of the test area should be done from a safe location which is itself monitored for the build up of CO. All monitoring equipment must be suitably calibrated and maintained.
- c) A second person should be present to raise the alarm if a problem is met and then render assistance if it is safe to do so.
- d) Specific consideration should be given to the safe conclusion of the test. In most cases it should be possible to arrange for the gas supply/appliance controls to be isolated from a safe place and for windows/doors to be opened from outside to allow ventilation so that the products of combustion can disperse when the simulation is finished.
- e) No entry into a test area should be made where the level of CO exceeds 200ppm.
- f) All means of escape from the site of the investigation should be unlocked to ensure easy exit if necessary; potential obstacles should be removed and there should be adequate lighting.
- g) The effect of weather conditions, particularly wind speed and direction should be considered.
- h) A plan should be prepared detailing what action should be taken:
 - i. Where an emergency shutdown of the equipment under test is required
 - ii. At the end of the simulation
 - iii. In case of emergency

4 All persons involved in the investigation should observe from a safe location, where necessary monitored for the presence of CO (not required e.g. in the open air).

5 Members of the public, householders etc. should be excluded from the test area and any other areas that might be affected by ingress of CO.

APPENDIX A

CARBON MONOXIDE INCIDENT INVESTIGATION

CONTENTS

Introduction

Incident Investigation

RIDDOR

Investigation Process

Appendix 1 – Flow Chart for Dealing with Flueless Appliances

Appendix 2 – Flow Chart for Dealing with Flued Appliances

INTRODUCTION

HSE is concerned that in attempting to comply with the perceived requirements of IGE/GL/8 and hence allowing levels of CO in excess of 700ppm to build up during routine incident simulation, dangerous conditions could inadvertently be experienced.

When there is no duty holder involvement HSE do not require centre room levels of CO to exceed 30ppm for non-fatal incident investigations. For incidents likely to result in a prosecution and all fatal incidents the level should not normally exceed 200ppm CO unless a specific risk assessment has been carried out.

INCIDENT INVESTIGATION

Certain gas CO incidents are reportable to HSE under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR) reg 6 (1) (see below). Investigation of those involving natural gas is carried out by or on behalf of gas suppliers in fulfilment of their duties under the Gas Safety (Management) Regulations 1996 (GSMR). In the case of LPG incidents, although reportable to HSE under RIDDOR, there are no GSMR duties but investigations may be carried out by or on behalf of HSE, for example where there may be a duty holder under Gas Safety (Installation and Use) Regulations 1998 (GSIUR).

When a death has occurred, the police or coroner's officer may carry out their own investigations to furnish evidence about the cause of death for inquests (fatal accident inquiries in Scotland). Additionally, there may be a police investigation when there are potential manslaughter charges. Frequently, however, the police and coroner use the expertise of the gas supplier's investigator to collect and present evidence.

Simulation testing, by operating the gas appliances in their as found condition, is one tool available to investigators. This should only be performed after a risk assessment has been carried out and where it is essential to the purpose of the investigation and when it can be done safely. Results of simulation tests are often inconclusive as it can be difficult to recreate all the circumstances and conditions at the time. Some

considerations in the investigation process are given below. The investigation and the levels of CO in the property should in general be in line with the flow diagrams in the Appendices.

RIDDOR

RIDDOR reg 6(1) applies when someone has died or suffered a major injury in connection with gas, unless the major injury was reportable under RIDDOR reg 3 (1) (e.g. in the course of employment). For CO exposure, the relevant major injury conditions are:

- a) An injury requiring resuscitation or admittance to hospital for more than 24 hours
- b) Loss of consciousness caused by exposure to CO
- c) Acute illness requiring medical treatment resulting from inhalation of CO

Acute illness means illness which:

- a) progresses rapidly to a crisis after the onset of symptoms
- b) severe symptoms

Medical treatment covers hospital treatment, and treatment by a GP.

INVESTIGATION PROCESS

1 Establish the reason for the investigation and its extent:

- a) GSMR investigation should:
 - i. Confirm that CO was involved
 - ii. Confirm that CO is being produced and identify its source
 - iii. Identify the reason for the production of CO
 - iv. Identify the reason for the spillage of combustion products
 - v. Identify the reason for the build up of CO
- b) Investigation for the coroner should in addition to the above aim to confirm that sufficient CO can be produced to result in the level of COHb found by the pathologist.

2 Establish depth of investigation:

- a) Is there a death or a duty holder?
 - i. Where there is no death or duty holder it would not normally be necessary to exceed a CO level in the room/dwelling of 30ppm for flued appliances or 90ppm for flueless appliances, whilst still answering the questions in section 1a above
 - ii. Even where there is a death or duty holder and carrying out a simulation is worthwhile and necessary, it would not normally be necessary to exceed a CO level of 200ppm. The time versus CO level should be recorded up to 200ppm and gas rates and room volumes should be taken to enable a calculation to be made to answer section 1b above

- b) What other parties are involved?
 - i. HSE (must always be contacted before an investigation is started)
 - ii. Coroner's officer
 - iii. Police

3 Initial checks:

- a) Information received prior to investigation e.g. from police, Transco, COHb levels
- b) History – previous service, problems, age etc
- c) Witnesses – knowledge and observations – which appliances were in use, conditions at the time
- d) Site – physical lay out, fluing arrangements, ventilation provision, doors and windows and whether open or closed at time of incident
- e) Weather (at incident time and at time of investigation)
- f) Visual indications – appliance setting, staining
- g) Examination and inspection of installation, appliances and flue system

4 Initial tests:

- a) Do not exceed 30 ppm CO in the centre of the room for flued appliances
- b) For flueless appliances do not exceed 90ppm CO as long as 30ppm is not exceeded for longer than 20 minutes in the centre of the room

- c) Flame picture
- d) Combustion performance
- e) Spillage tests
- f) Flue flow tests
- g) Apply the decision trees in Appendices 1 and 2

5 Build-up simulation testing should only be carried out where appropriate and in line with the controls set out in the risk assessment:

- a) Identify the reason for the test - Is the information likely to be obtained both necessary and relevant to the satisfactory completion of the investigation?
- b) Consider risks to others both in the test and adjoining properties
- c) When CO levels rise above 30ppm in the centre of the room monitor from outside the test area
- d) Build-up tests can be carried out up to a maximum of 200ppm CO in the centre of the room
- e) Arrange for the test appliance to be turned off remotely and for ventilation to be carried out without entering the test area post test. Where this is not practical and entry to the property is necessary ensure another person, who must not enter the property, is available to summon help in an emergency. Beware of very rapid build up and where this cannot be avoided take appropriate action without entering the property. In extreme circumstances consider involvement of emergency fire service

6 Full simulation test:

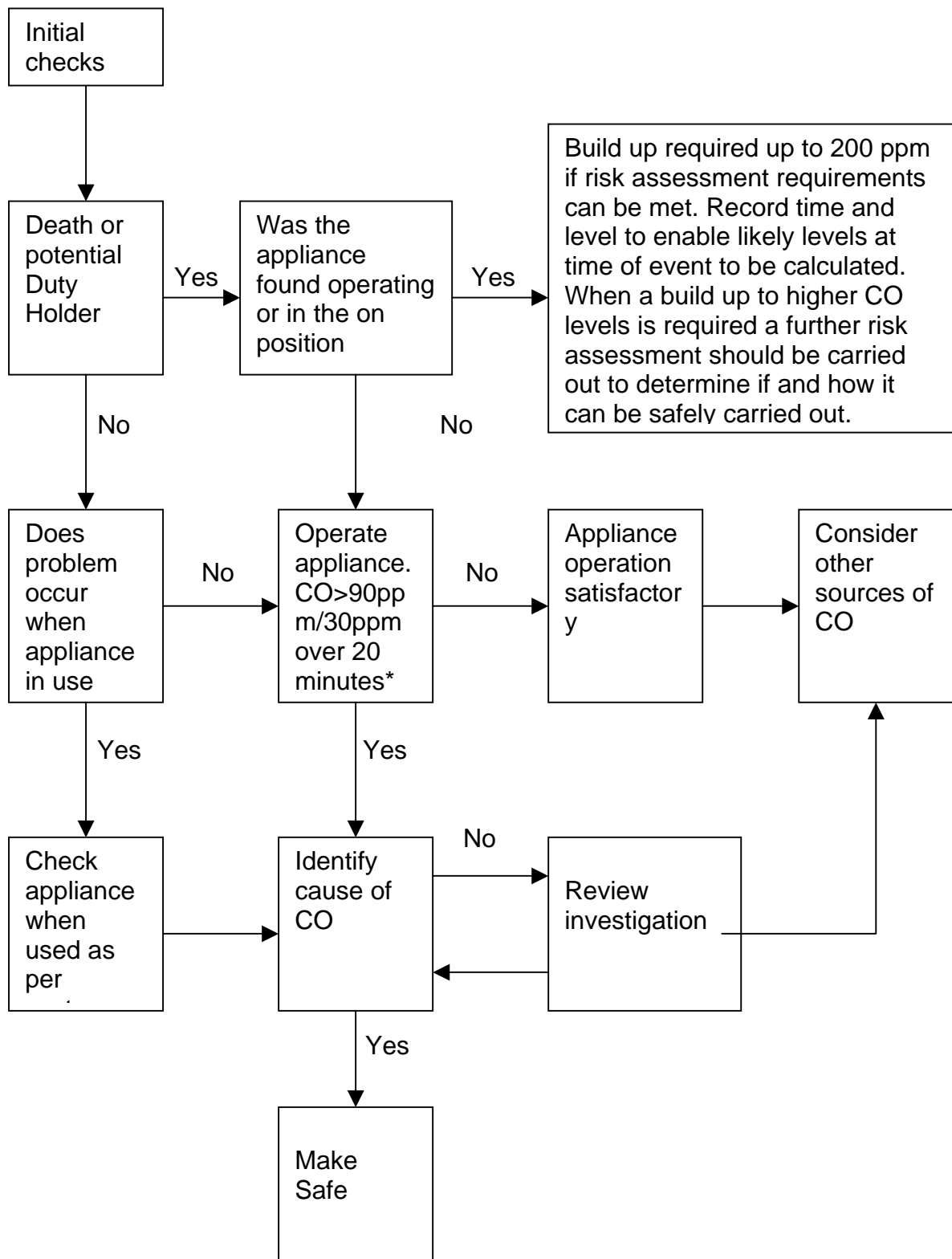
There may be exceptional circumstances where build up beyond 200ppm CO is necessary. Always carry out a separate risk assessment before proceeding. At least 2 people must be present and arrangements must be made for external remote isolation of the gas supply and ventilation of the property. It will also be necessary to monitor any attached properties either side of the test property.

7 Attendance at Coroner's Courts:

In the case of fatalities where the report is likely to be used in Coroner's Court it will be necessary to include a section in the report where the CO levels likely to be reached are calculated.

APPENDIX 1

FLUELESS APPLIANCES



* It is not usual to operate water heaters for longer than 5 minutes

APPENDIX 2

FLUED APPLIANCES

